DOCUMENT RESUME

ED 127 174 SE 021 211

AUTHOR Dyrud, Grace H.; Page, Laura M.

TITLE Numeration: MINNEMAST Coordinated Mathematics - Science Series, Unit 6.

INSTITUTION Minnesota Univ., Minneapolis. Minnesota School Mathematics and Science Center.
SPONS AGENCY National Science Foundation, Washington, D.C.
PUB DATE 71
NOTE 113p.; For related documents, see SE021201-234
AVAILABLE FROM MINNEMAST, Minnemath Center, 720 Washington Ave., S.E., Minneapolis, MN 55414

EDRS PRICE MF-$0.83 HC-$6.01 Plus Postage.
DESCRIPTORS *Curriculum Guides; Elementary Education; *Elementary School Mathematics; *Elementary School Science; Experimental Curriculum; *Interdisciplinary Approach; Learning Activities; Mathematics Education; *Number Concepts; Primary Grades; Process Education; Science Education; Units of Study (Subject Fields)
IDENTIFIERS *MINNEMAST; *Minnesota Mathematics and Science Teaching Project

ABSTRACT

This volume is the sixth in a series of 29 coordinated MINNEMAST units in mathematics and science for kindergarten and the primary grades. Intended for use by kindergarten teachers, this unit guide provides a summary and overview of the unit, a list of materials needed, and descriptions of five groups of activities. The purposes and procedures for each activity are discussed. Examples of questions and discussion topics are given, and in several cases ditto masters, stories for reading aloud, and other instructional materials are included in the book. The five sets of lessons in this volume review the idea of correspondence between sets, and introduce counting and numeration by tallying and with numeral symbols. An optional section concerns the values of coins. (SD)

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UNIT 6

MINNESOTA MATHEMATICS AND SCIENCE TEACHING PROJECT

MINNEMAST COORDINATED MATHEMATICS–SCIENCE SERIES

KINDERGARTEN

1. WATCHING AND WONDERING
2. CURVES AND SHAPES
3. DESCRIBING AND CLASSIFYING
4. USING OUR SENSES
5. INTRODUCING MEASUREMENT
6. NUMERATION

FIRST GRADE

7. INTRODUCING SYMMETRY
8. OBSERVING PROPERTIES
9. NUMBERS AND COUNTING
10. DESCRIBING LOCATIONS
11. INTRODUCING ADDITION AND SUBTRACTION
12. MEASUREMENT WITH REFERENCE UNITS
13. INTERPRETATIONS OF ADDITION AND SUBTRACTION
14. EXPLORING SYMMETRICAL PATTERNS

SECOND GRADE

15. INVESTIGATING SYSTEMS
16. NUMBERS AND MEASURING
17. INTRODUCING MULTIPLICATION AND DIVISION
18. SCALING AND REPRESENTATION
19. COMPARING CHANGES
20. USING LARGER NUMBERS
21. ANGLES AND SPACE
22. PARTS AND PIECES

THIRD GRADE

23. CONDITIONS AFFECTING LIFE
24. CHANGE AND CALCULATIONS
25. MULTIPLICATION AND MOTION
26. WHAT ARE THINGS MADE OF?
27. NUMBERS AND THEIR PROPERTIES
28. MAPPING THE GLOBE
29. NATURAL SYSTEMS

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NUMERATION

MINNEMAST COORDINATED MATHEMATICS-SCIENCE SERIES

UNIT 6

MINNESOTA MATHEMATICS AND SCIENCE TEACHING PROJECT

4

The Minnesota Mathematics and Science Teaching Project

developed these materials under a grant from the

National Science Foundation

FIFTH PRINTING
1971

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MINNESOTA MATHEMATICS AND SCIENCE TEACHING PROJECT

Director

DR. JAMES H. WERNTZ, JR.
Associate Professor of Physics
University of Minnesota

This unit, Numeration, was developed by the MINNEMAST staff from earlier MINNEMAST materials in the light of the experience of the many teachers who have tried the activities in the classroom. This trial edition, Unit 6 of the MINNEMAST Coordinated Mathematics-Science Series, was produced under the leadership of:

GRACE H. DYRUD
Chairman, Psychology Department
Augsburg College

LAURA M. PAGE
Kindergarten Consultant
MINNEMAST Staff

Supporting Staff

LEON KNIGHT
Editor

ELIZABETH IHRIG
Editorial Assistant

SONIA FORSETH
Associate Art Director

MINNEMAST
720 Washington Avenue S.E.
Minneapolis, Minnesota
55414

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Complete List of Materials for Unit 6

(Numbers based on class size of 30.)

total number required to teach unit	item	lessons in which item is used
1 each	sets of blocks, counters, toy animals, etc.	1
30	*** sets of Minnebars	1,5,6,7, 18,24
600	counters or beads of several colors	3,4,9,10, 15,17,22, 23
25	** sheep cut-outs: 20 large, several small	4
1	flannel board	4,17
10-12	objects for flannel board	4,17
7-12	large blocks	10
1	large sheet of paper	10
7-12	connectors	10
22	containers or *souffle cups	10,20
30	sheets of plain paper	10
1	set of number perception cards	13
1	tom-tom, drum or piano	16
30	* sets of numeral cards -- 0 through 10	19,20,21, 23
1	larger set of numeral cards	19
10-20	sheets of 9" x [illegible] paper to make display cards	19,21
	stickers -- st[illegible], etc. (optional)	19
30	* clear plastic bags	23
5-10	sets of common objects, e.g., 6 pencils	23

30 each	real coins: pennies, nickels and dimes	24
1 set	* play money	24
	** pictures of coins	24
1-2	large sheets of cardboard or sandpaper (optional)	25
30	boxes of crayons (optional)	25
30	sheets of newsprint (optional)	25
35	**Worksheets 1-5	

* kit items as well as

** printed materials available from Minnemath Center,
720 Washington Avenue S.E., Minneapolis, Minn. 55455

*** available from The Judy Company
310 North Second Street, Minneapolis, Minnesota 55401

INTRODUCTION

PURPOSE

This unit contains activities that:

- Review one-to-one correspondence.
- Develop an understanding of number concepts.
- Give practice in the representation of numbers by reference sets, tallies, symbols, and number words.
- Develop proper counting procedures.

COMMENTARY

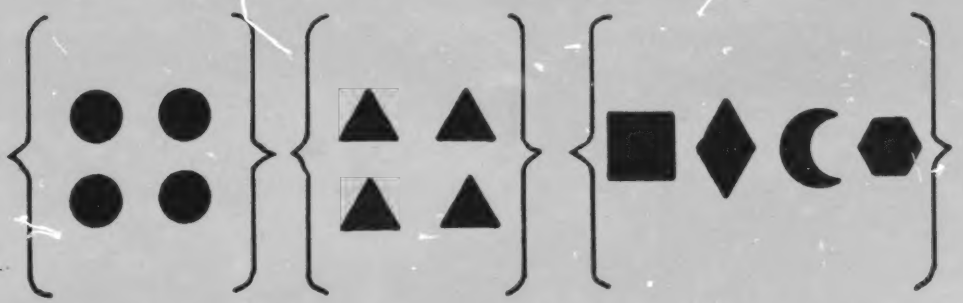
Many kindergarten children are able to recite the sequence of English number words up to ten and some can continue up to one hundred. While they may be able to recite the sequence very well, their recitation of the words may get out of step with their "checking off" of the members of a set that they are counting. This difficulty arises because the children do not understand the importance of the one-to-one pairing of a numeral and an object -- "one" paired with the first object, "two" with the second object, etc.

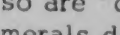
An adequate understanding of number and counting involves the process of one-to-one pairing of a series of numerals (in sequence beginning with "one") and a set of objects. The one-to-one pairing of the objects of two sets in Unit 3, Describing and Classifying, gave the children experience with this process. In that unit, the sets to be compared were sets of physical objects and were simultaneously available.

Frequently, however, we may wish to compare sets when they cannot easily be brought together or when they are not simultaneously available. For example, we may wish to compare the number of chairs in Room A with the number of chairs in Room B. We may wish to compare a set at one time with that same set at another time, e.g., the set of children in the kindergarten class before and after a field trip. Although the sets

of children cannot be compared directly, we can construct a set equivalent to one of the sets of children and use it as a reference for comparison with the other set. If we take a ticket for each child who leaves on the field trip, there should be a child for each ticket on the way back -- the reference set of tickets should be equivalent to the set of returning children. If this equivalence does not exist, the two sets of children are not equivalent -- either a child has been lost or an additional child acquired (assuming the set of tickets has not been altered). The set of tickets represents the number of members in the set of children since it is an equivalent set -- a set that contains the same number of members. Ugboo, in Lesson 2, collects a set of stones equivalent to his set of sheep -- a set of the same number of members as the set of sheep.

Representing a number is simply giving it a name. The names for numbers of things are called "numerals." They are abstractions and are not to be confused with the real things. The word "cloth" is the name we give to a piece of woven material -- it is not the material itself. Similarly, we use names such as "one," "two," "three," "four," etc., to describe a property of any set in the world containing the appropriate number of members. The number-numeral distinction can be illustrated in the following way. The sets shown have a similar property, the property of number. In these sets a numeral which represents or names the number of members in each set is "four."



"Four" is a symbol for the number of members in each set, and so are "quatre," "vier," "  ," "4," and "IV." All these numerals describe the property of "fourness." The distinction between number and numeral should be made whenever this meaning clearly involves one and not the other. Insofar as possible, use the words correctly, but do not try to teach this distinction to the children.

The lessons proceed from using equivalent sets of objects to using tally marks as reference sets. The marks are also paired, one by one, with the objects in the original set to establish an equivalent set.

One of the difficulties in using tally marks, however, is that we must carry all the marks with us and re-match every time we use the tally marks. If we wished to remember that a set contained one hundred objects, we would have to carry one hundred tally marks and match each of them with one of the objects. In counting, however, we are able to pair numerals in a specific sequence with the members of a set of objects. The established sequence -- arbitrarily decided by our culture -- is important for effective communication because we need to remember only the name of the numeral paired with the last object. If, for example, we have a set of 100 objects, the number of objects can be more efficiently represented by one special symbol or name -- "100" or "one hundred" -- than by a reference set of 100 objects of 100 tally marks. Thus, the counting series is an abstract equivalent set that has many advantages over equivalent sets of real objects or tally marks.

Counting involves ideas of transitivity, as do the other indirect comparisons already mentioned. The "equality," "less than," and "more than" relations are transitive. For example, if Set A has more members than Set B, and if Set B has more members than Set C, then Set A has more members than Set C. This concept was developed in the preceding unit, Introducing Measurement. Similar statements can be made for the "equality" and "less than" relations. The children should also have experience with substituting one equivalent set for another. For example, if Set A contains the same number of members as Set B, and if Set B contains more members than Set C, then Set A contains more members than Set C, etc.

NOTES ON TEACHING THE UNIT

The unit is divided into five sections, each of which emphasizes a particular topic. The sections are divided into lessons, most of which are planned to take approximately one class period. When many activities are provided in a lesson, your class may not need to do every activity, but some activities from each lesson should be used. It is expected that the entire unit will require about six weeks.

In some lessons suggested questions are printed in capital letters. These should be considered only as guides, not as required questions. Similarly, the answers printed in parentheses are not the only acceptable answers.

SECTION I USING REFERENCE SETS

PURPOSE

- To use one-to-one correspondence for determining which of two sets has the greater number of members.
- To develop the construction of equivalent sets and their use as reference sets in the comparison of the number of members in other sets.
- To introduce Minnebars as devices that can be used extensively in the development of mathematical concepts.
- To reveal that rearranging or redistributing a set does not alter the number property of the set. (Conservation of number.)

COMMENTARY

In this section, Lesson I emphasizes the number property of sets by having the children make one-to-one comparisons without counting. Lessons 2-4 continue the concentration on number by the use of an equivalent set as a reference set in such comparisons. Then the number property of Minnebars is introduced and used in Lessons 5-7 to lay the foundation for later work on addition and subtraction.

Some activities are similar to those of earlier units but are used here in the development of new ideas. Some will be repeated in the first grade. For example, the Ugboo story of Lesson 2 will be used again in Unit 9, Numbers and Counting, where the children will be expected to understand its implications more fully. This points up the fact that the ideas started in kindergarten will be treated again in later grades and it is not expected that the kindergarten children will do more than begin the process of mastering them.

Lesson 1: ORDERING SETS BY NUMBER OF MEMBERS

In this lesson, one-to-one correspondence is used for ordering sets, from the one containing the least to the one containing the most number of members. The basis for judgment here is pairing rather than counting.

MATERIALS

- blocks, counters, toy animals, etc.
- Minnebars

PROCEDURE

[A] Form three sets of children with two, four and eight members. The emphasis will be on ordering the sets according to the number of members. The sets can be named for their leaders (Jean's Set, Jim's Set,...) or by letters (Set A, Set B,...). Have the children compare each set with the other sets by one-to-one pairing. Then have the set with the least members stand in one area of the room. Have the children compare the other two sets by pairing and then order all the sets from least number of members to the most. The children who are not members of any of the sets should do the pairing and ordering of the sets.

Choose someone to put more members in Set B (which has 4 members) to make a new set, Set D, with as many members as Set C (which has 8 members). Although sets C and D now have the same number of members, they are called <u>equivalent</u> sets, not equal sets. Recall for your own benefit the discussion of this point in the teacher's materials in Unit 3, <u>Describing and Classifying</u>. Use the term correctly but do not require the children to use it. Any of the following statements is correct:

Set C has as many members as Set D.

Both sets have the same number of members.

The sets can be matched.

C and D are matching sets.

The sets are equivalent.

Repeat the activity with sets containing other numbers of members, using numbers that are closer together and numbers greater than five so that the one-to-one matching becomes more necessary.

[B] Repeat Activity A substituting blocks, counters, toy animals, etc., in the sets. Have the children form sets of objects distinguishable by color or type so that the sets are not confused. For example, they could use red, blue, and yellow blocks or toy horses, pigs, and dogs. Have the children decide which set has the least, the next to the least and the most number of members by one-to-one pairing. Have them compare any two sets and arrange these two in order. Then have them compare the third set with one or both of the first two, and include this third set in the ordering. Have them go on to include four or five sets when they seem able to order three easily.

[C] Any other games that involve ordering by comparison will aid the children in learning the ordering concept. Most children enjoy ordering Minnebars by length, rings by size, nesting toys by size, blocks by size, pieces of cloth by color shade. (Be sure there is a noticeable difference in the shades.)

Lesson 2: COMPARING THE NUMBER OF MEMBERS IN DIFFERENT SETS

This lesson introduces in story form the idea of constructing a set of objects that is equivalent in number to an original set of objects. It also shows the use of such a reference set in comparing the number of members in two sets.

The story that forms the basis of this lesson is not expected to be as meaningful mathematically to the kindergarten children as it will be to them when they encounter it again in Grade 1, but it is expected to introduce them very pleasantly to important concepts that are developed later.

MATERIALS

- story, "Ugboo's Big Problem", pp. 9-29

PROCEDURE

Show the cover page and read the name of the story. Explain that although this is just a made-up story for fun, it does tell about the actual way some early people kept track of the number of their animals.

Stop at those places where the children seem eager to discuss Ugboo's problem. Let them talk freely about the pictures, listening closely to see if you need to explain further.

If the children seem puzzled at any point in the story, stop and reiterate the point in your own words. Wherever you feel it advisable, explain very explicitly just what Ugboo is doing.

(The story of Ugboo is reproduced here and again in Unit 9, Numbers and Counting.)

UGBOO'S

BIG PROBLEM

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Minnesota Mathematics And Science Teaching Project

Here is Ugboo. He lived a long, long time ago. This is the way he counted: "One -- two -- many." He did not know any other way to count more than two. At that time no one knew how to count more than two.

Ugboo had a job. He watched sheep. He watched the sheep of the whole tribe. Every morning he would open the gate to the fenced-in sheep fold and let the sheep out one by one. Then he would take them to a grassy place. Ugboo had to watch the sheep while they ate grass. He had to keep his eyes open because the lions and the wolves like to eat sheep. They would steal sheep and eat them if Ugboo wasn't looking. At night Ugboo would take the sheep home and put them into the fold again.

One evening when Ugboo came home with the sheep, the chief of the tribe met him. The chief's name was Zarathustra. In those days the chief of the tribe always had a long name to show that he was important. Zarathustra looked at the sheep. He said, "Are these all the sheep of the tribe? Don't you have more?"

Ugboo answered, "These are all the sheep of the tribe. They are the same sheep we had this morning."

Zarathustra said, "There don't seem to be as many sheep. Did you fall asleep today while you were supposed to be watching them? I think you did."

Ugboo began to cry. "I did <u>not</u> fall asleep. I kept my eyes open all the time."

Zarathustra was angry and shouted, "I think you fell asleep and a wolf or a lion stole some sheep. It looks as though there are fewer sheep than there were before. If you lose any more sheep, I will punish you, Ugboo! The tribe needs the sheep for wool, skin, and meat." Then the chief went away.

Ugboo was very sad. He said to himself, "How can I be sure that there are as many sheep now as there were before? How can I show big chief Zarathustra that I did not lose any sheep? There were many sheep before and there are many sheep now. How can I, or anyone else, tell the difference between many sheep and many sheep?"

Ugboo was afraid of Zarathustra. The chief was the biggest and strongest man in the tribe. All the others were afraid of him, too. Ugboo did not want Zarathustra to punish him.

Ugboo thought and thought. He thought all evening about his problem. At supper his mother said, "Ugboo, why are you so quiet? On other nights you chatter all the time."

"I am thinking," Ugboo answered. Then he told his mother about his problem.

She said, "You are wasting your time. Everybody says, 'one -- two -- many,' and that's all there is. More than two is many. But now let's stop and eat. Here's a stone knife and a big piece of deer meat. Cut off a small piece for each of your brothers and sisters."

Ugboo did as his mother told him. He began to cut the meat and said, at the same time, "One piece for brother Nip, one for sister Snip, one for sister Snap, and one for little Norum." Then he carried the meat to the other children and gave one piece to each one. He gave himself a piece, too.

While they were eating, Ugboo said to himself, "One piece of meat for each child, one child for each piece of meat. No children left over. No pieces left over. There are just as many pieces of meat as children and just as many children as pieces of meat."

Suddenly he felt as though a light had lit up in his head. He felt as though he had been in the dark until now.

He jumped up and yelled, "I've got it! I've got it!"

His mother asked, "What have you got? A stomach ache?"

Ugboo said happily, "I know how to find out whether there are fewer sheep at night than in the morning. I know! I know!"

What answer do you think Ugboo found to his problem?

Let the children make suggestions.

As soon as Ugboo woke the next morning, he went to the edge of the lake near his cave. He took with him a sheepskin bag which his mother had made for him. He began looking for little stones and pebbles on the shore. He picked up every one he found, and put it in his bag. When the bag was full, he threw it over his shoulder and carried it to the sheep fold. He emptied the bag on the ground, and then let the sheep out of the fold, one at a time.

As each sheep left the fold, Ugboo put one pebble in the bag. Then he led the sheep to the big chief, Zarathustra.

"What do you want?" growled the chief.

"I want to give you this bag of stones," said Ugboo. "There is one stone in this bag for each sheep in the flock and one sheep for each stone. There are just as many stones as sheep. You can see for yourself."

The chief went back with Ugboo and began pairing the stones with the sheep. Sure enough, there was one stone for each sheep and one sheep for each stone.

Zarathustra muttered to himself. "Let's go over this again very slowly. I want to be sure -- really, really sure I understand this. Let me see. If there is one stone for each sheep, then there are at least as many stones as sheep."

He sat down and wiped the sweat from his forehead. He said to Ugboo, "This thinking business is hard work. I'm tired already -- I had better rest awhile."

After a few minutes he said, "Where was I? Oh, yes. There are at least as many stones as sheep. But there might be more stones than sheep. We might have one stone for each sheep, and still have some stones left over. Let us look. Are there any stones left over?"

Zarathustra started to look to see whether there were any stones left over. Ugboo reminded him, "Don't you remember, chief? There is one sheep for each stone. So there can't be any stones left over."

Zarathustra was puzzled. He wrinkled his eyebrows and thought. He thought very, very hard. Suddenly he began to smile.

"That's right!" he said. "That's absolutely, positively right! It is hard to think of all these things at one time. But once you do put it all together, it is really easy to see. Since there is one stone for each sheep, there are at least as many stones as sheep. Since there is one sheep for each stone, there are at least as many sheep as stones. As many stones as sheep . . . as many sheep as stones . . ." He looked from the stones to the sheep, to the stones, to the sheep, thinking.

Suddenly he pounded one fist into the palm of his other hand and shouted, "Of course! There are just as many stones as sheep!"

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Then he turned to the boy and asked, "What of it? Why are you taking up my whole morning with all this stuff? Why haven't you taken the sheep out to the grassy place yet? They must be hungry already."

Ugboo answered, "Don't you see? When I bring the sheep home tonight, you can pair the stones with the sheep again. You can put down one stone for each of the sheep. If there are no stones left over, then you will know that I have brought back all the sheep. If there are some stones left over, you will know that I have lost some sheep, and you can punish me."

Zarathustra said, "How is that again? If there are some stones left over, then . . . Let me think it over . . . Oh, don't bother me any more! Go tend your sheep right now, or I won't wait until tonight to punish you. Get going. Scoot! I have to go hunting. Do you think I have all day to talk to little boys?"

Then Zarathustra went hunting with some of his friends. During the hunt, he told the other men about what happened. "You know that boy, Ugboo? He came to me this morning with a long story about stones and sheep."

The chief began explaining to the men about one stone for each sheep and one sheep for each stone, but -- wouldn't you know -- he got it all mixed up! "I'm sure I understood it this morning," he said. "Now I am so dizzy, I am not sure of anything. Let's hunt now and talk about it at supper tonight."

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That night the chief talked it over with all the other leaders in the tribe. They were sitting around the fire in a circle, each one eating a chunk of meat he held in his hand, and they were arguing.

Finally, the chief said, "Let's call Ugboo," and he pulled Ugboo into the circle of men. "Explain what you told me this morning, Ugboo," he said.

Ugboo began to tell, slowly and shyly, how he had cut up the meat for his brothers and sisters. "There was one piece of meat for each child and one child for each piece of meat," Ugboo began, "and none left over."

"We don't want to hear about that," the chief said. "Tell the men about the sheep and the stones!"

"Well, the meat gave me the idea," Ugboo said. "I thought if it would work for the children and the pieces of meat, I might be able to pair each sheep with something, too. Then I thought of the stones. I collected a lot of stones and put them in this bag my mother made for me. When I went to the sheep fold this morning, I dumped all the stones on the ground. Then, for every sheep that came out of the fold, I put one stone in the bag. There were just as many stones in the bag as there were sheep -- one stone for one sheep.

"And tonight, when I brought the sheep back to the fold, I took a stone out of my bag each time a sheep went in the gate. When all the sheep were back in the fold, my bag was empty. There was exactly one stone for every sheep -- just as there had been in the morning. There were no sheep left over and there were no stones left over. That's how I know I brought back just as many sheep tonight as I took out this morning."

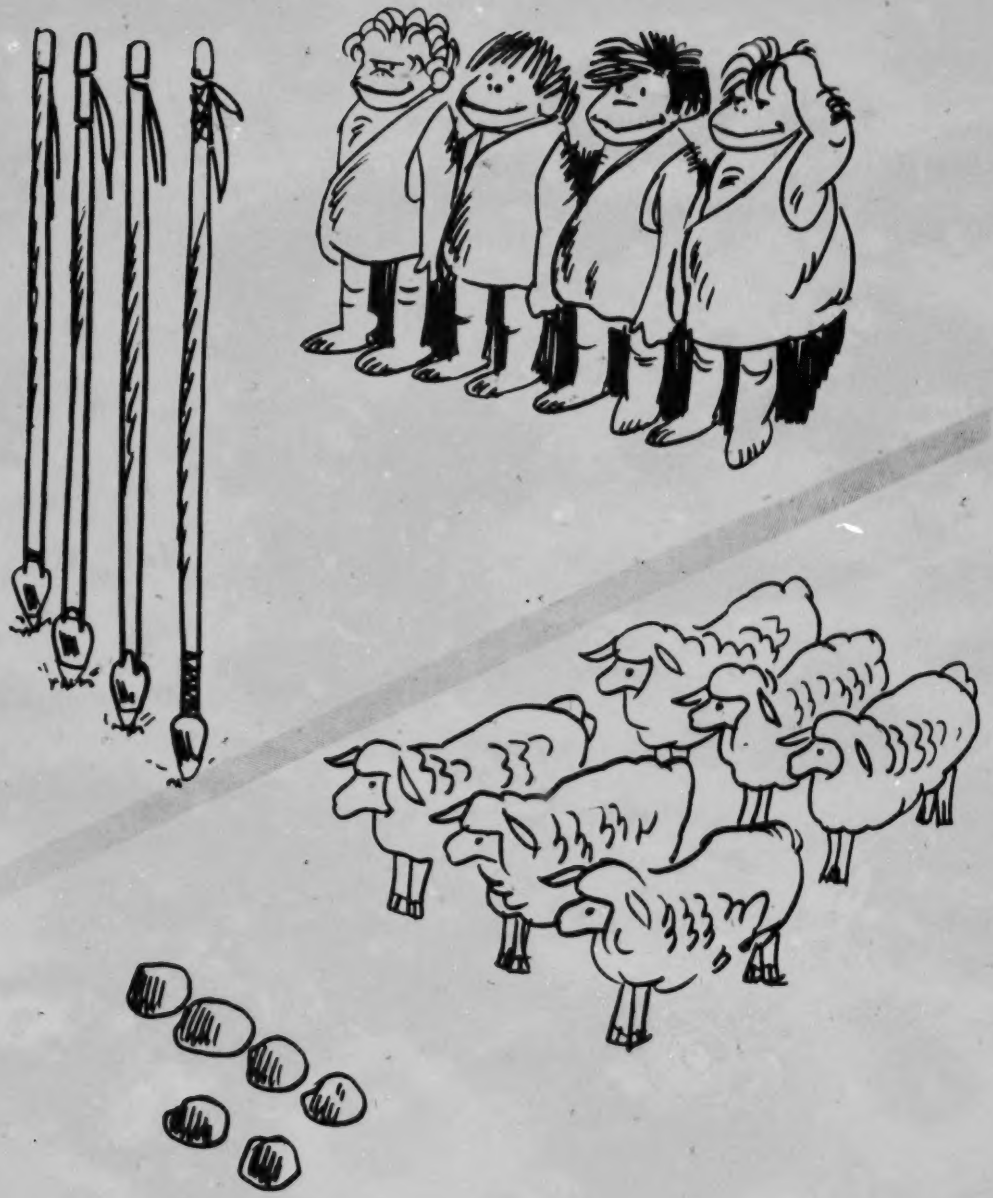
When Ugboo finished, all the men were quiet for a while, thinking. Then they began to ask questions.

"Would this work with other things, too?" one of the men asked. "If there is one spear for each man, and one man for each spear, then are there just as many spears as men?"

Another man asked about people and noses. Another one asked about knives and bones.

At last Zarathustra said, "This is a wonderful discovery and I have thought of another way to use it. If we have two sets and want to know which one has more in it, all we have to do is pair one thing in the first set with one thing in the other. We keep on matching one for one. When we are done, if there are any left in one set, then we know that that set has more. If there is nothing left over in either set, then there are just as many in one set as in the other."

All the men agreed that this was a very good idea. One of the men said, "Ugboo is a very clever boy. We ought to do something for him." The others said, "Yes, he deserves a reward."



Then the big chief, Zarathustra, said to the boy, "We are going to give you a great honor. We are going to give you a name just as long as the big men have. Then everyone will know that you are a very important person. From now on, we will call you 'Uggabugaboo.'"

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Uggabugaboo's mother and brothers and sisters all ran up to him and hugged and kissed him. His father patted him on the back and shook hands with him. No other boy in the whole tribe had ever had such an honor.

When he grew up, Uggabugaboo became a very big chief himself. Then he was called Uggabuggabuggabuggaboo. He was really important then.

Historical basis for the theme of Ugboo's Big Problem is to be found in a book by Richard Starr, Nuzi: Report of the Excavations at Yorgan Tepa, near Kirkik, Irag (Harvard University Press, 1939). The report notes the finding of "a large number of inscribed clay texts, one of which was the extraordinary tablet of 'Zikarri the shepherd.'" Roughly egg-shaped and hollow, with a hole at its pointed end, it bears the inscription "stones of the sheep" followed by a list of animals given to "Zikarri the shepherd," presumably for grazing. Inside the tablet were forty-nine pebbles.

Lesson 3: CONSTRUCTING EQUIVALENT SETS

Various activities in this lesson give the children experience with the concept (introduced in "Ugboo") of equivalent set and the construction of an equivalent set. They also introduce simple experiences with conservation of the number of a set under rearrangement.

These activities allow the children to act out the process of one-to-one pairing of stones and sheep that Ugboo uses in the story. As they match stones and sheep and use the stones to check the number of sheep, they will also have an opportunity to see that whether the sheep stand huddled together in one place, or spread out after the matching with the stones, there will still be a sheep for every stone (as long as no sheep is lost).

MATERIALS

- counters or beads to use as stones

PROCEDURE

[A] Pick a set of eight or ten children to be sheep. Separate them from the rest of the class. Give a stone (counter) to each "sheep." While each sheep is holding his stone, ask:

ARE THERE MORE SHEEP THAN STONES?

ARE THERE MORE STONES THAN SHEEP?

ARE THERE THE SAME NUMBER OF SHEEP AS STONES?

EACH SHEEP HAS ONE STONE, AND NO STONES ARE LEFT OVER, SO THERE ARE THE SAME NUMBER OF STONES AND SHEEP.

After repeating with other sets of sheep as often as you think necessary, have a set of sheep put their stones on the floor. Be sure there is plenty of space between the stones. Repeat the above questions. Ask how they could check their answers.

WHAT WOULD HAPPEN IF EACH SHEEP PICKED UP A STONE?

WOULD THERE BE EXTRA SHEEP? EXTRA STONES?

LET US CHECK.

Have each sheep pick up a stone.

Have the children discuss what happened and discover that there were the same number of sheep and stones.

Repeat with other sets of sheep.

[B] Ugboo Game: Choose a child to be Ugboo. Give him a set of 10 to 15 stones (counters). After Ugboo has chosen an equivalent set of children as sheep, have him lead them to a part of the room designated as the sheep fold. Ask Ugboo:

ARE ALL YOUR SHEEP STILL WITH YOU?

HOW DO YOU KNOW?

After he has set up a one-to-one correspondence between his sheep and the stones, have him lead them back to the fold. Repeat the above questions and check.

In summarizing the activity describe the checking process carefully:

WHEN WE PUT ONE STONE TOGETHER WITH ONE SHEEP AND DO NOT HAVE ANY LEFTOVER SHEEP OR ANY LEFTOVER STONES, WE SAY WE HAVE THE SAME NUMBER OF SHEEP AND STONES.

When the checking process is clearly understood, have one of the sheep hide so that the check will be incomplete, etc.

Choose another child, Nip, to be Ugboo's brother. Nip chooses any number of sheep for his set. Ask a child:

WHO HAS MORE SHEEP TO CARE FOR, UGBOO OR NIP? HOW DO YOU KNOW?

The two sets of sheep can be paired or Nip's sheep can be paired with Ugboo's stones.

After constructing a reference set of stones for Nip's sheep, have one sheep "get lost" when Nip takes them to pasture. How will the children know that one is lost? (There will be a stone leftover.) Let the children find this out by pairing stones and sheep.

Lesson 4: PRACTICE WITH EQUIVALENT SETS

The lesson provides variations of the activities of Lesson 3. Use these or similar ones that you think will best reinforce the concepts for your class.

MATERIALS

- cutouts of sheep (20 large, a few small) for the flannel board (see page 35)
- beads or counters
- 10 or 12 objects for the flannel board

PROCEDURE

[A] Tell the children to pretend that some flannel board cut-outs are Ugboo's sheep and some beads are stones. The flannel board is the fold. Put some sheep in the fold so that all the children can see them.

Choose a child to be Ugboo. He picks up one stone for each sheep in the fold and gives them to another child, Chief Zarathustra. The chief removes one sheep from the flannel board and places it on a table. He puts one of the stones beside it. He continues this procedure until he establishes that there are as many stones as sheep and vice versa.

After the set of sheep has been matched, rearrange the sheep and ask the child:

NOW HOW MANY STONES SHOULD THERE BE--
MORE, LESS, OR THE SAME NUMBER AS BEFORE?

Have him and others check the answer.

Repeat this activity with other sets until it is obvious to the children that rearranging the members of a set does not require changing the set of stones used to represent the number of the set. It is necessary to have this concept firmly

established because an adequate understanding of number involves knowing that the number of members does not change when the members are rearranged.

Next substitute another small cutout for one of the larger sheep.

IS THIS SET OF SHEEP THE SAME AS THE ONE BEFORE? (No, it is not the same set.)

WILL YOU NOW NEED MORE, LESS, OR THE SAME NUMBER OF STONES TO REPRESENT THE NUMBER OF THIS NEW SET OF SHEEP? (The same number since the two sets of sheep are equivalent.)

You may repeat this using other sets of objects to reinforce the fact that the number of a set (as represented by another set) is unchanged if one member is replaced by another.

[B] Use a variety of situations involving parts of the body in relation to numbers and pairing, e.g.:

HOLD UP AS MANY FINGERS AS YOU HAVE EYES; EARS; MOUTHS; ARMS; NOSES; LEGS.

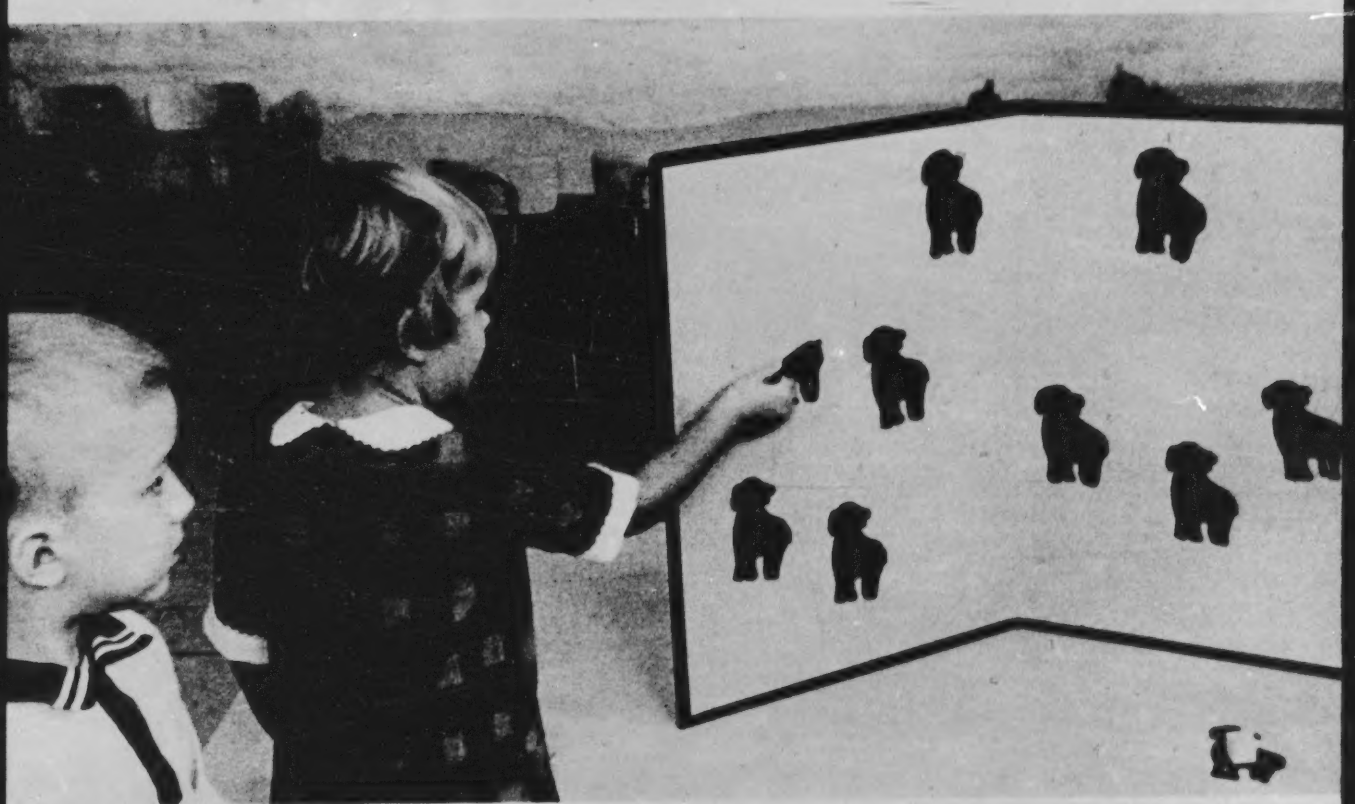
WILL THE SUBSET OF CHILDREN WHO THINK THEY HAVE AS MANY FINGERS AS THEY HAVE TOES STAND UP?

Hold up four fingers.

WILL THE SET OF CHILDREN WITH THIS MANY LEGS STAND BY THE WALL? (Empty set.)

Have a child hold up a few fingers. Choose another child to bring as many objects as the number of fingers held up. The first child then puts his hand on the table with only the outstretched fingers touching the surface. Have the second child place the objects next to the fingers in one-to-one pairing.

C Place a set of 10 to 12 objects on a flannel board or on a table. Have the children discuss how they can tell when they come back the next day whether all of the objects are still there. Hopefully someone will suggest making an equivalent set of reference objects. If not, give them a hint by displaying a set of counters or tokens. Let the children make the pairing between objects and counters and then put the reference set of counters in a safe place. After they have made the check for a day or two, try rearranging the set of objects without changing it otherwise.



The cutouts of sheep that are supplied for this lesson were made from the following patterns.

Lesson 5: MATCHING COUNTERS AND MINNEBARS

The following activities are designed to emphasize that in using Minnebars we are concerned at this time with the number of units represented by each bar rather than its length. Therefore, the activities are centered around the one-to-one comparison of counters or objects with the unit-length segments of the bars.

Small Minnebars can be used as counters to be placed on the large demonstration Minnebars in these activities. If you do not have the demonstration bars, give the children paper clips or small pieces of soda straws to use as counters on the small bars. The children can continue the activities individually or in small groups after the demonstrations.

Although we have asked you to specify each bar by color, we unfortunately cannot do so in these directions since the various "editions" of Minnebars differ in the coloring of their bars.

MATERIALS

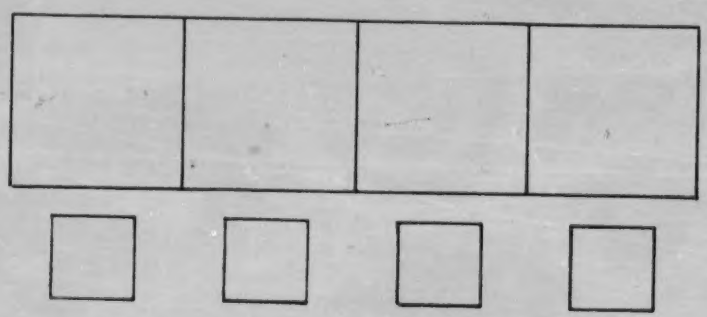
- set of large demonstration Minnebars
- small 1-unit Student Minnebars, or some other counters

PROCEDURE

[A] Lay out four 1-unit demonstration bars. Ask a child to pick out the same number of small 1-unit bars or counters. Have him check his selection by making a one-to-one pairing with the large bars by putting a small bar on each large bar. Repeat using various numbers of large 1-unit bars. This activity provides an opportunity to see the one-to-one correspondence of the number of units, even though the sizes of the units differ.

[B] Now lay out a 5-unit demonstration bar and ask a child to pick out as many small 1-unit bars as there are 1-unit sections in the large bar. Again have him place the small bars on the large units as a check. Repeat, using other large bars.

C Select two demonstration bars of equivalent length. Have the children check their lengths. Ask a child to pick out as many small 1-unit bars as there are units on one of the large bars. He should place these in a row below one large bar to check his selection.



Have another child do the same with the other large bar and other small 1-unit bars.

Move the large bars to the side.

Now have the same two children make a one-to-one comparison of their sets of small bars, and also compare the lengths of the large bars. Repeat this, with various pairs of equivalent large bars, to develop the idea that bars of the same length contain the same number of unit-lengths -- their units match with the same number of counters.

D Repeat Activity C, but now with two large bars of different lengths. These will produce inequalities when their equivalent counter sets are compared. For example, a "5" bar is longer than a "3" bar and there are more members of the "5" set of counters than of the "3" set, etc.

E Repeat Activity D with three large bars of different lengths. Order the bars by lengths and the sets by number of members.

Lesson 6: MATCHING MINNEBARS

You are not expected to teach mathematical concepts directly in this lesson. These concepts are almost self-taught through discovery when the children follow the rules of the games. Have the Minnebars available at other times and encourage the children to come back to them often to play new games as their interests develop.

The games of this lesson expose the children to thought processes used in numeration, addition, and subtraction. They should be repeated as seems appropriate.

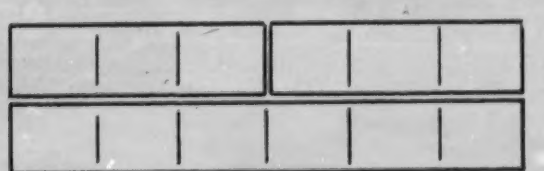
MATERIALS

- Minnebars

PROCEDURE

As you distribute the Minnebars, have the children order them by length for a short time. This will call attention to the various lengths and also to ordering by length or by number of units. Do not attempt to guide this ordering to perfection at this time, but go on to the activities.

[A] Hold up two bars, each no longer than the five-unit bar. Have the children find two bars like the ones you hold up and place them end to end. Ask the children to find one bar that is just as long as these two bars combined. Tell them that they have "matched" the two shorter bars with the longer bar.

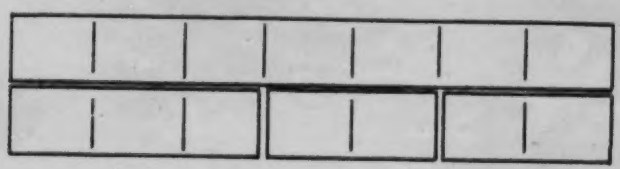


THE LENGTH OF THE (state color) BAR MATCHES
THE LENGTH OF THE (state colors) BARS.

Repeat with other pairs of bars.

There should be no counting of the units on the bars. The colors of the bars should be used in identifying them; refer to "this bar" or "the yellow bar" rather than "the four-unit bar." The children need not always have the unit division marks on the bars visible.

B Ask the children to match one long bar with several shorter bars. Any combination or number of shorter bars may be used to match this one large bar. For example, a seven-unit bar may be matched in this way:

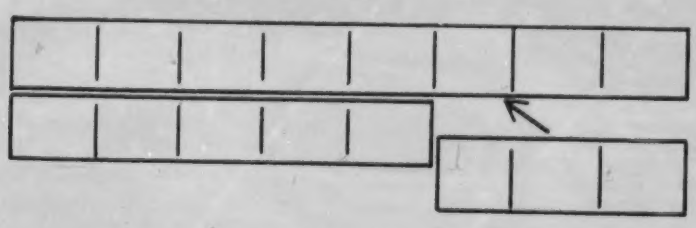


A (state color) BAR CAN BE MATCHED BY (state colors) BARS.

Ask the children to find different ways to match the long bar.

Repeat with a different long bar.

C Take two bars of different length. Ask the children to find the bar that, when combined with the shorter bar, will match the longer bar.



A (state color) BAR COMBINED WITH A (state color) BAR WILL MATCH A (state color) BAR.

Repeat with other combinations to match the same long bar and other long bars.

Lesson 7: MORE MATCHING WITH MINNEBARS

The activities show that the only single kind of bar that can be used to match every Minnebar is the 1-unit bar, and also that the longer bars can be matched with several combinations of shorter bars.

MATERIALS

- Minnebars

PROCEDURE

[A] Always naming each bar by color, show the children a 10-unit "target" bar matched with only two bars -- a 4-unit and a 6-unit bar (5 and 5, 3 and 7, etc. will also work, of course). Ask them to try to find as many ways as possible to match the long bar with just two other bars. Ask them if they can do it using only two bars of one color. Repeat using other "target" bars of various size.

[B] Ask the children to match a 6-unit bar with two bars of the same color. Ask if they can find another way to match the 6-unit bar using bars of only one color (more than two such bars can be used -- three 2-unit or six 1-units). Repeat with other target bars. Lead the children to see that all the bars can be matched using only 1-unit bars. As the activity continues, have the children match each longer bar with 1-unit bars and note that each length can be matched this way.

Have the children try to match a few lengths using only 2-unit bars. They will find some bars cannot be matched using only these bars, e.g., 3 and 5-unit bars.

[C] Have the children find which bars can be matched using just two bars of the same color, and which bars cannot be matched in this way. All the bars containing an even number of units can be so matched, but all children will not find all these bars.

SECTION 2 REPRESENTING NUMBERS BY TALLIES

PURPOSE

- To introduce tallies as a reference set.

COMMENTARY

Tallying is the act of setting up a one-to-one correspondence between each member of a set and a reference mark. A similar pairing is involved in counting correctly. Tallying is introduced here to strengthen the child's understanding of number and as a background for counting, which is developed in the next section.

Although it is not important that tally marks be made in any particular way, each child should understand that he is to make one mark for each object or activity that fits a particular description. Proceed as slowly as necessary to ensure that all children keep up with the work. However, it is not expected that all children will completely master the activities in the lessons of this section.

Lesson 8 introduces the idea of using tally marks for pairing in one-to-one correspondence through a story, "Tal's Aching Back." In Lesson 9, the children dramatize the story of "Tal" to develop the idea of tallying. Lesson 10 has the children use tallying to compare the number of members of sets, first by tallying objects and matching the tallies and then by matching the sets directly. The children then have the experience of tallying events rather than objects. Lesson 11 includes activities that show various ways tallying can be used.

Lesson 8: MAKING SETS OF TALLY MARKS

A story, "Tal's Aching Back," introduces the idea of using tally marks (instead of stones) for pairing in one-to-one correspondence. This explanation for the development of tallying is completely fictional; historically the counting process evolved very slowly.

MATERIALS

- story, "Tal's Aching Back," pp. 43-49

PROCEDURE

[A] This activity involves the idea of substituting something lighter for the stones Ugboo used. Begin by reminding the children of Ugboo and his chief. Then ask:

SUPPOSE UGBOO'S CHIEF WANTED TO CHECK THE NUMBER OF SHEEP OUT IN THE PASTURE BEFORE THEY CAME BACK, BUT HE DIDN'T WANT TO CARRY THE HEAVY SACK OF BIG STONES; COULD HE SUBSTITUTE SOMETHING ELSE FOR THE STONES -- SOMETHING THAT WOULD BE EASIER TO CARRY? (The children may suggest such things as leaves, twigs, etc.)

[B] Read "Tal's Aching Back" to the class, encouraging discussion whenever you think it would benefit the children. Point out that the story is "made up."

(Tal story as in Unit 9, Numbers and Counting.)

TAL'S ACHING BACK

TAL'S ACHING BACK

Tal was Ugboo's great-great-great-great-grandson, which means Tal lived many years after Ugboo. By this time everyone in Tal's tribe had learned about Ugboo and his great invention. Everyone carried around a little sheepskin bag of stones. Whenever anyone wanted to compare sets that were far away from each other, he would match a stone with each member in the first set. Then he would carry these stones to the other set and match each of the stones with a member in the second set. In this way it was easy to find out which of two sets had more members than the other.

Since the people in Tal's tribe lived by the shore of a lake, they often caught fish for food. Very often they had more fish than they needed for themselves.

The people also hunted for food with bows and arrows. But the right kind of stone for the arrowheads could not be found near the shore of the lake. So when the people in Tal's tribe had extra fish, they would trade with another tribe and receive arrowheads in exchange.

One day Chief Vishtapaka came to Tal and said, "We have a lot of extra fish. Put them into a big sheepskin bag and take them over to the Annuki tribe on the other side of the hill to trade for arrowheads. Be sure that you get enough arrowheads to give one to each hunter in our tribe."

Tal put the fish in a large sheepskin bag. Then he put one stone for each hunter in his tribe into another bag. There were many hunters in the tribe, so there were many stones in the bag. Tal put the bag of fish over one shoulder and the bag of stones over the other shoulder and started up the hill.

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It was a hot day and the sun beat down on Tal's head. By the time he reached the top of the hill, he was hot and tired and sweaty. He sat down and rested before going down the other side of the hill. When Tal reached the bottom, he went to the chief of the Annuki tribe and said, "My chief, Vishtapaka, has sent me to trade these fish for arrowheads. He wants one arrowhead for each stone in this bag."

After Chief Darayavush of the Annuki tribe agreed to make the trade, Tal emptied his bag of fish, took the stones from the other bag and placed them neatly on the ground. Chief Darayavush then put one arrowhead next to each stone. When the trading was finished, Tal placed the arrowheads in the large bag in which he had had the fish and began his long climb back up the hill to go home to his own tribe.

In the afternoon, the sun felt even hotter than before. The bag of arrowheads on Tal's shoulders seemed very heavy. By the time he came down the other side of the hill, his back and shoulders felt very sore indeed. He stumbled into the camp and let the bag of arrowheads slip down to the ground. "Here are the arrowheads, Chief Vishtapaka," he said wearily. "There is one arrowhead for each hunter in the tribe." The chief was very pleased and gave Tal a friendly clap on his back.

"Ouch, my aching back!" moaned poor Tal, as he went to find some shade under a big tree.

As he was resting, his friend, Ningal, came to him. "Tal, why are you lying there?" she asked.

Tal sighed, "I have been carrying fish and arrowheads and stones all day."

"Why?" Ningal asked.

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"Because I had to trade fish for arrowheads. I had to get one arrowhead for each hunter, so I took along one stone for each hunter to tell me how many hunters there were."

Ningal felt sorry for Tal. She said, "There must be some better way to keep track of how many hunters there are than by carrying around a heavy bag of stones."

They sat there, thinking. Then Tal began playing with a stick and a sharp rock. Without thinking he made a row of scratches on the stick.

Suddenly Ningal jumped up. "I have a wonderful idea. You could carry something that wasn't so heavy as a bag of stones."

> WHAT SET DID NINGAL THINK OF FOR TAL TO CARRY? ("Marks on a stick." But go on with the story rather soon, even if no one suggests this answer.)

"You could make a mark on the stick for every hunter and then carry the stick over the hill to the Annukis."

Tal shouted, "Wonderful! Then when I arrived there, I could ask for one arrowhead for each mark. That would be the same number of arrowheads as I got for my stones. One arrowhead for each stone -- one arrowhead for each mark -- one mark for each hunter! And my back wouldn't be so sore."

Tal and Ningal explained to the other people in the tribe their new way of comparing sets. Everyone found it much easier to match tally marks with the members in a set than to carry around all those heavy stones. They called their new method "tallying."

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Lesson 9: DRAMATIZING "TAL"

Through dramatization, this lesson should reinforce the idea of tallying presented by the story.

MATERIALS

- counters or other objects to represent arrowheads and fish

PROCEDURE

Have the children discuss and plan the dramatization of the story of "Tal": what characters are needed and what material each character should have to play his part. Choose children to be Tal, Ningal, Chief Vishtapaka and Chief Darayavush. The other children can be the people of the two tribes.

Lesson 10: TALLYING

This lesson uses tallying to compare the number of members in sets under various circumstances and to record various events or activities. If other suitable activities occur to you, feel free to use them.

MATERIALS

- blocks
- large sheet of paper
- counters
- connectors
- container

PROCEDURE

[A] Put a set of 7 to 12 large blocks in front of the children. Give a few children counters and have them put 1 counter on each block. Remove the counters and place them in a row on a large sheet of paper on the floor. Have a child make a tally mark beside each counter.

ARE THERE AS MANY TALLIES AS BLOCKS?

Have the children check by putting a block beside each tally mark and pairing the tallies and blocks by connectors.

Move the blocks apart.

ARE THERE STILL AS MANY TALLIES AS BLOCKS?

HOW CAN YOU CHECK?

If necessary, give them help in pairing a tally with each block by moving the connectors.

B Have the class tally the number of children who have shoes that strap and the number who have shoes that tie, the number in the subset wearing blue jeans and the subset wearing red dresses, etc. Compare the two sets in each case, first by matching tallies and then by matching the sets directly.

C In this activity, events rather than objects are tallied. The event is your saying "beep." Each time you say "beep," put a counter into a container.

Tell the class that they are going to tally -- they are to make a mark whenever they hear you say "beep." Demonstrate by saying "beep," putting a counter in the container, and making a tally mark on the chalkboard or paper. Repeat a few times.

HOW WILL WE KNOW HOW MANY TIMES I HAVE SAID "BEEP"? (The number of counters in the container is the reference set for checking.)

Give each child a piece of paper and tell him to get ready to make a mark everytime you say "beep." Repeat "beeps" with a rhythm of slow counting and put a counter in the container as you say "beep." (You may wish to precede this with some rhythm activity.) After a few "beeps," check the counters against various children's tallies or let a child make the check. Repeat the activity. When the children begin to tally properly, they can join in saying "beep" in chorus with you, then make the tally mark.

Lesson 11: USING TALLYING

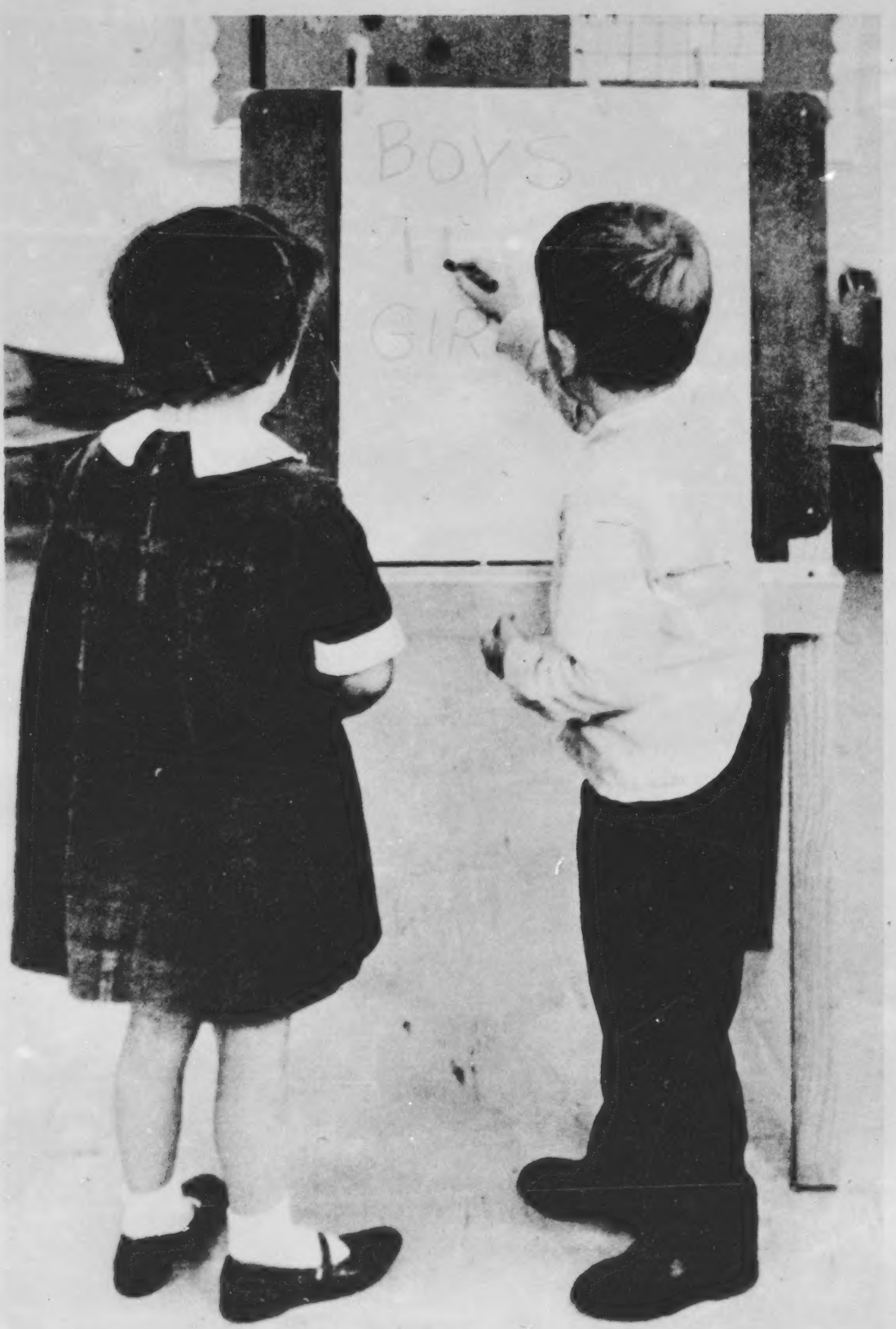
This lesson suggests various ways that tallying can be used.

PROCEDURE

[A] Ask for a tally of the number of children absent. Have a boy make a tally mark on the chalkboard for each boy who is absent. Ask a girl to do the same for each absent girl. Have the girl make the tallies directly under those made by the boy. If the class cannot tell which set has more children absent by looking at the tally marks, have a child draw connecting lines with different color of chalk from the tallies in the boys' row to those in the girls' row. If one set has marks that cannot be paired, that set has more absent.

[B] Have the class tally the number of times that some repeated, observable event occurs during the day, such as the number of times the bell rings, the number of visitors entering the classroom, or the number of knocks on the door.

[C] Many games, such as the "Bean Bag Game," in which children toss bean bags through a hole in a board, give good opportunities for using tallying in keeping score.


BOYS

SECTION 3 COUNTING

PURPOSE

- To introduce number words.
- To develop proper counting techniques.

COMMENTARY

The lessons of this section concentrate on having the children properly match number words in the counting sequence with the members of the set being counted. As pointed out in the introduction, this is frequently a problem for many children.

Lesson 12 uses another fictional situation in introducing the use of number words as an equivalent reference set. Lessons 13 and 14 give the children practice in associating appropriate counting words with the number of members in a set. Practice in counting is provided in a variety of activities in Lessons 15, 16, and 17. The number property of the Minnebars is emphasized in the matching activities of Lesson 18.

Lesson 12: INTRODUCING COUNTING

Another fictional story is used to introduce the idea of counting and the use of number words.

MATERIALS

- story, "Nat's Numbers," pp. 57 to 63

PROCEDURE

Read "Nat's Numbers" to the class. Once again explain to the children that the story is "made up." It really took many years for people to learn to count, but it is fun to pretend that Nat and his tribe learned to count the way the story tells it. As with the other stories, allow plenty of opportunity for class discussion of the various points as they arise. Follow the reading by dramatizations and related activities.

("Nat's Numbers" as in Unit 9, Numbers and Counting.)

NAT'S NUMBERS

Many years after Tal lived, his great-great-grandson, a boy named Nat, was sitting with Zelona, a girl of the tribe, on a small hill overlooking the village.

"My grandmother told me that long ago the tribe carried bags of stones to help them compare sets," Nat said. "Sticks with tally marks are certainly a lot easier to carry, but they still are a lot of trouble."

"Yes," Zelona said, "making the marks on the sticks takes a lot of time, and yesterday my friend Tanana dropped her tally stick over the cliff. Then she didn't know how many fish her mother wanted her to bring home."

"Is there something else that would be easier to make and easier to carry?" Nat wondered.

As Nat sat there thinking and rubbing his fingers over the tally marks scratched on a stick, Zelona suddenly pointed down towards the village and said, "Oh, look! The herdsman is bringing your grandfather's goats back to the village."

But Nat didn't look up and still sat there thinking and rubbing his fingers over the tally marks.

"Aren't the goats beautiful?" Zelona went on. "And I know the name of each one. There goes Kunye, Beli, Tatu, Kune, and Hlanu."

"Zelona!" Nat exclaimed. "We can match words with the tally marks! Every time I felt a mark, you said a name. We could carry a list of words in our heads. Then to find out how many fish we had, we could pair each fish with a different word."

"That sounds like a good idea," Zelona said. "But we don't have any names for the tally marks."

"Since it was the names of the goats that gave me the idea," Nat said, "why not give the tally marks the same names as the goats?"

And this is what they did. They named their tally marks "kunye, beli, tatu, kune, hlanu, tupa, bathu, ngulu, danisa, and bumda."

THIS WAS THE LANGUAGE NAT AND ZELONA SPOKE.
WHAT DO YOU THINK THE ENGLISH WORDS MIGHT BE?
(One, two, three, four, five, six, seven, eight, nine, ten.)

After they had figured out the number names, Nat said, "Let's see if pairing these words really works. I'll say some of the words while you get a stone for each word. Then you say the same words while I get a stone for each word. Then we'll see if we each have the same number of stones."

Nat said the goat names for "one, two, three, four, five, six," while Zelona put down a stone for each word. Then Zelona said the words and Nat put down the stones.

(Have two children do this.)

"Do our piles really have the same number of stones?" Zelona asked. "How can we tell?"

HOW DO YOU THINK THEY COULD TELL?
(One-to-one pairing will show that the sets contain the same number of stones.)

"We can pair the stones," Nat said. "We will take one from your pile, one from mine."

(Show the picture of Nat and Zelona pairing six stones. Have two children pair the sets formed above.)

After they had matched their sets of stones, Zelona called out happily, "They do have the same number! We can use number names instead of tally sticks!"

Nat and Zelona explained their system to the older people of the tribe. They then taught the other people the list of number names.

On the next trading trip for arrowheads (after they had memorized the number names), the men tried the new method. They liked it very much. The men paired one word with each arrowhead they needed. The last word they said told them the number of arrowheads. They called this method "counting." Of course, they had to remember to say the words in the same order each time or it wouldn't work. Until they got used to this method, they often got all mixed up.

Because there were more than ten members in some sets, the tribe had to invent more number words.

WHAT WORDS COULD BE USED AFTER TEN?
(Let the children count as far as they wish.)

Lesson 13: NUMBER PERCEPTION AND COUNTING RHYMES

Parts of the body such as fingers, toes, arms and legs should be used frequently in counting and pairing. Included here are a few activities as suggestions. The children can make up similar activities. There are many counting rhymes that can be used effectively at this time. A few are provided.

The emphasis here should be on having the children match a number of fingers with a number of objects. The use of the number perception cards gives practice in recognizing small numbers without counting.

MATERIALS

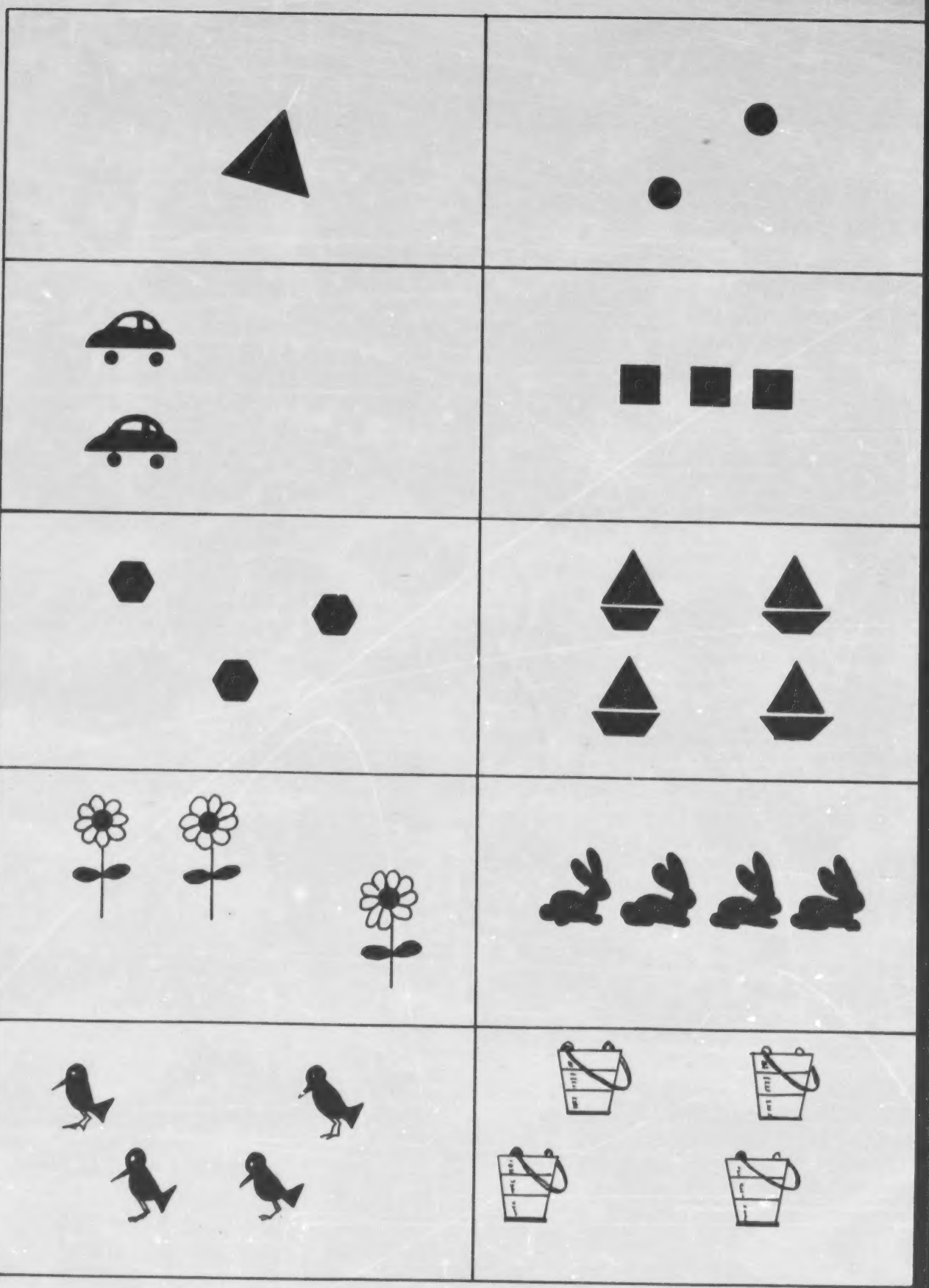
- number perception cards

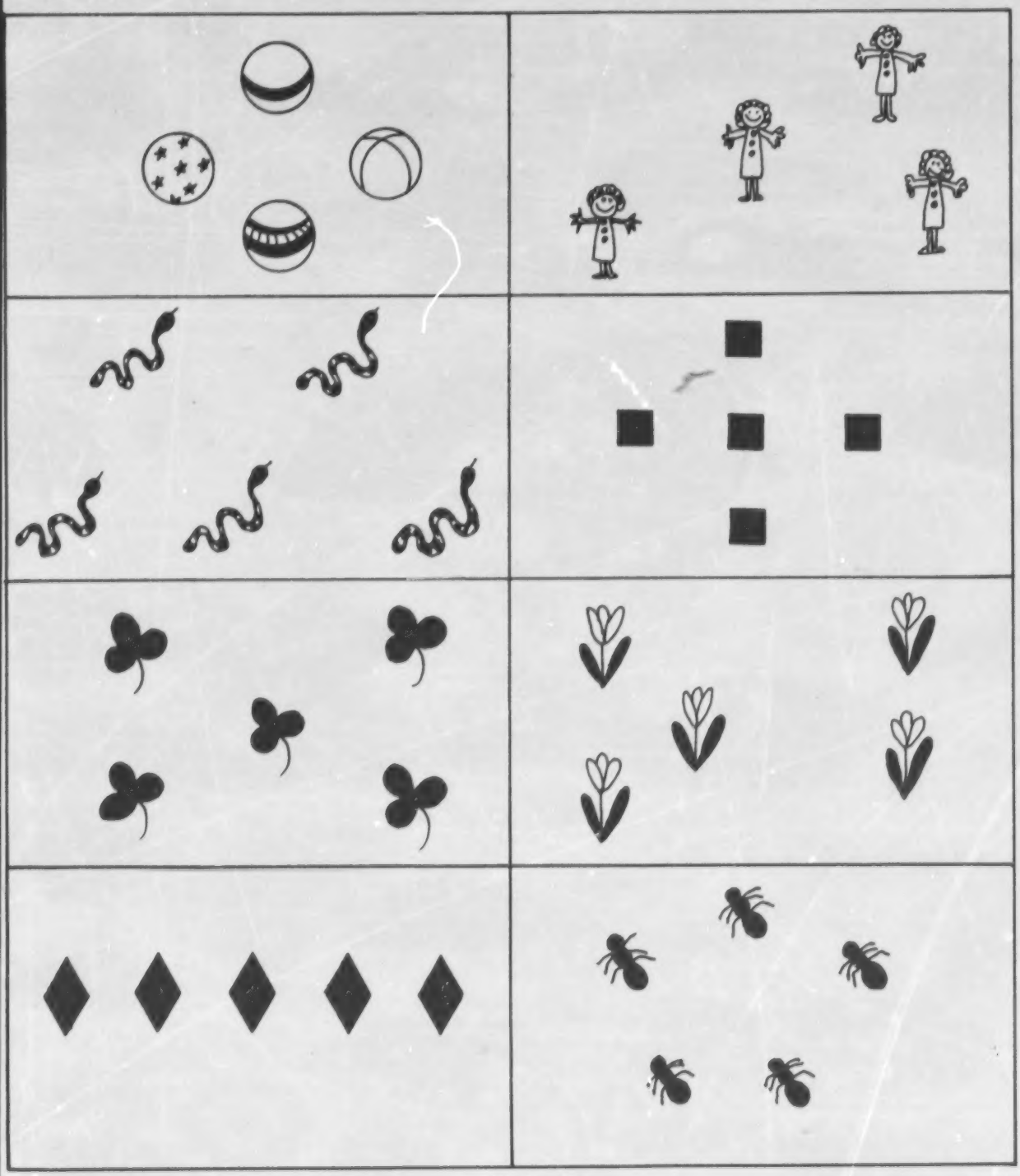
PROCEDURE

[A] Make up cards (at least 3" x 5") with sets of pictures similar to those on pages 65 and 66. Preferably these should be made by drawing or pasting on small pictures. In some sets, all the pictures should be of the same type of objects; in others, they should include a variety of objects.

As you show these cards, have the children hold up the number of fingers that correspond to the number of members of the sets and say the appropriate number word.

[B] Read the counting rhyme beginning on page 67 (or others like it) to the children. Have them use their fingers to show the number in each rhyme.





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COUNTING RHYME — ONE, TWO, THREE

I know one.

One head have I,
One nose, one mouth,
One Me.

I know two.

Two hands have I,
Two feet, two ears,
Two eyes to see.

I know three.

A field of three-leaf clover!
However long I look for four.
I find three, no more.

I know four.

Four feet on my dog.
Four feet on my cat
– Fancy that!

I know five.

Five fingers on each hand.
Five toes in each shoe.
How many have you?

I know six.

Six legs on a cricket.
Six legs on a fly.
Catch them, count them
as they go by.

I know seven.

Seven days in every week.
Seven days to play,
Seven nights to sleep.

I know eight.

Eight notes in the scale.
Sing them high, sing them low
– do re me
fa sol la
ti do!

I know nine.

Nine boys play baseball
on my brother's team.
But no room for me – how mean!

I know ten.

Ten fingers, ten toes,
Wiggling and wiggling.
But I can't seem to wiggle
my
one
nose!

Ten, nine, eight,
seven, six, five,
four, three, two, one.
Then nothing at all.

I know zero!
Nothing at all!
No tail, no fins,
no wings have I.

I've zero fins and
zero wings.
But I'm not zero.
I'm still me.

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Lesson 14: COUNTING POEMS AND FINGER PLAY

This lesson continues the use of fingers and counting poems to reinforce the ideas developed in Lesson 13.

PROCEDURE

Throughout the rest of the school year, use counting poems and finger play activities similar to those given below. In using them have each child hold up the appropriate number of fingers. Several of the poems use the ordinal number words, that is the words "first," "second," "third," etc., rather than the cardinal number words "one," "two," "three," etc. It is perhaps best to establish the ordinal words in such informal ways.

One bunny, two bunnies, three bunnies
dear,
Four bunnies, five bunnies -- yes, they're
all here.
They're the dearest little bunnies alive --
One, two, three, four, five! (Touch
fingers as you count.)

Two ears, two eyes, one mouth, one
nose (point)
Ten little fingers and ten little toes.
Let's play rag doll.
Don't make a sound.
Fling your arms and bodies
Loosely around.
Fling your hands -- fling your feet,
Let your hands go free.
Be the raggiest rag doll
You ever did see.

Five fat geese sitting in a line.
The first one said, "My the weather's fine."
The second one said, "But I feel a chill."
The third one said, "It's coming round the hill."
The fourth one said, "We better not delay."
The fifth one said, "Let's take off today."
And in the sky a "V" they drew,
As away to the sunny South they flew.

Lesson 15: DETERMINING NUMBER OF OBJECTS BY COUNTING

This lesson presents activities in which the emphasis is on counting objects. In addition, there will be many opportunities for the children to practice counting during their kindergarten activities. One child may count out the number of toys to take to a small group, another the number of pieces of paper his group needs, etc.

MATERIALS

- counters of several colors

PROCEDURE

[A] Place 5 or 6 counters at one end of a table and ask someone to volunteer to count them. After the child has told how many counters he thinks are there, count out a second set of a different color, equal in number to the announced result of the first set. Then have the child match the counters in the two sets by one-to-one correspondence. If he has counted correctly, the sets should pair exactly.

Repeat the above, choosing a different number for the first set (gradually increasing the number) and have a different child do the counting.

The children may need help in separating a counter for each word as they count. If they seem unable to understand this procedure, try having a child count some of the children. As each child is counted, he sits down.

[B] Repeat the first part of Activity A, this time using counters of several different colors. Spread the counters out on the table. Ask the children to count only the color you say, and then continue as before -- counting and matching the second pile. This makes it imperative for the child to separate each counter from the group as he counts, in order to be accurate.

C The Kitty Game: Seat the class in a circle. Choose a child to be the mother cat. She lies down in the middle of the circle. Mother cat chooses three children to be baby kittens (more babies can be chosen if the mother can count higher). The kittens lie near the mother, who then pretends to fall asleep.

Say: "Baby kittens and Mother cat
Are lying on the sleeping mat.
Mother cat lies fast asleep.
Kittens too make not a peep.
But the kittens like to play.
So softly now they run away."

The kittens find places to hide. When all are hidden, say:

"Mother cat wakes up to find
All her babies gone."

Mother cat awakes and meows. The kittens answer and mother cat finds them by following the sound of the calls. When a kitten is found, he sits in the middle of the circle. When mother cat thinks she has found all her babies, she counts to be sure. Sometimes say to the mother cat, "You've found your first baby. Now find your second baby." (This will accustom the children to the ordinal number words.)

Lesson 16: DETERMINING NUMBER OF SOUNDS BY COUNTING

Here the activities involve the counting of words or sounds rather than objects. Many similar activities will occur to you for use in continuing review of the counting process.

MATERIALS

- tom-tom, drum or piano

PROCEDURE

[A] Have the children count as you clap your hands or tap your pencil on the table. Choose someone to tell you how many times you did it. Begin by giving slow, evenly-paced taps of small number. As the children become more accurate in their counting, increase the number of taps and then the speed of the tapping. If the class seems very good at listening and counting, you might try tapping in an uneven rhythm to see whether they can still count the signals correctly.

[B] Play four distinctly separate chords on the piano, hit the tom-tom (or drum) four times, or clap your hands four times.

LISTEN WHILE I PLAY SOME NOTES ON THE PIANO
(HIT THE TOM-TOM OR CLAP MY HANDS.)

HOW MANY TIMES DID I PLAY THE PIANO?

NOW TAKE A STEP EACH TIME THAT I PLAY THE PIANO. HOW MANY TIMES DID YOU STEP?

[C] After singing a new song to the children, repeat it, asking them to count how many times you sang one of the words that is repeated frequently in it. Suggest that they use tallies to help keep track of the count.

Lesson 17: MORE COUNTING ACTIVITIES

This lesson reinforces the proper use of counting procedures with more counting activities.

MATERIALS

- flannel board
- cutout objects to use as sets
- counters

PROCEDURE

[A] Place one set of objects on the flannel board. Have the children count the set several times, first in chorus, then individually. At first begin the counting with the same object each time. Later ask the children if the number of objects would change if the counting started with a different object.

Rearrange the objects of the set; have the children count again. Substitute a large object for a smaller member of the set; repeat the counting. Elicit the observation that the result of the counting is not changed. Add or remove set members and ask:

NOW WILL WE GET THE SAME NUMBER WHEN WE COUNT? LET'S COUNT AND SEE.

[B] Have the children separate a set of objects into subsets and count each subset.

[C] For practice in making sets with a specified number of members, have a child count aloud a given number of objects and place them on the flannel board, in a cup, or on a desk.

D Appoint a child as banker. Give each of the other children one counter. Each child in turn comes forward and places his counter on a pile before the banker.

Each time the banker says, "I have _____ counters. You give me 1. Now I have _____ counters." The banker counts each time before he says how many counters he has. (For the many children who can already add 1, this step may need to be done only once or twice.) Children take turns being banker.

After some experience with the game as described, a child may come forward and say, "You have _____ counters. I give you 1. Now I think you have _____ counters. Count and see whether I am right." The banker checks by counting.

The game may be varied by giving each child two objects to place in the pile during each turn.

The banker may also give away 1, 2, or 3 at a time. He would say, "I have _____ things. I give you _____. How many do I have left?" The recipient must count to check.

Lesson 18: MATCHING MINNEBARS BY NUMBER OF UNITS

This lesson continues Minnebar matching but emphasizes the number of units in the bars. Now the bars should be referred to by their number names as well as by color.

MATERIALS

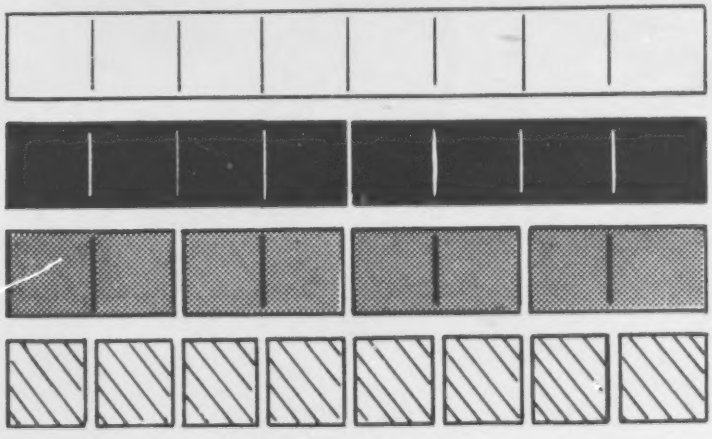
- a set of Minnebars for each child

PROCEDURE

[A] Review some of the Minnebar matching activities from Lessons 6 and 7, now using the number names for the bars. Make statements that help the children move from focusing on color to focusing on number of units -- "All the black bars are one-bars," etc.

[B] Ask the children to match the 6-unit bar using only 3-unit bars. Next, ask them to match the same bar using only 2-unit bars. Point out that in each of these matches, the "target" was matched by using only bars of the same length -- of the same number of units.

Now select another even-unit bar and ask the children to match it using only bars of the same length. After one solution has been discovered, ask for another way of matching the target. Have the children place their solutions directly under each other. The following illustration shows some of the solutions for an 8-unit bar.



C Have the children use only 1, 2 and 3-unit bars to match any larger bar. To make this more interesting, the smaller bars may be called "shots" and the larger bar to be matched can be the "target." Here the children see who can hit the target in the least number of shots. (You may wish to have them keep track of their shots by using tally marks.)

More able students can be challenged to investigate whether they can play this game using only 1, 2 and 4-unit bars as shots; that is, can all the bars be hit using only these three lengths of bars?

SECTION 4 REPRESENTING NUMBERS BY PRINTED NUMERAL SYMBOLS

PURPOSE

- To introduce printed numerals.
- To introduce the relations between numbers and numeral symbols.
- To give practice in associating numerals with numbers.
- To provide practice in ordering numbers in sequence.

COMMENTARY

This section suggests many activities that give the children practice in associating printed numerals with numbers. This involves a degree of abstract thinking that may be difficult for some children at this time. It is important that they have a good foundation in understanding counting before they begin reading numerals. You should use your own judgment as to how many of the activities to use and for which children they are appropriate.

Lesson 19 introduces printed numerals to the children. Lesson 20 emphasizes the number sequence. Lessons 21 and 22 give the children more practice in counting. Several activities are suggested in which the children increase numbers by one or two. This provides some pre-addition experience and practice in predicting and checking totals up to ten. Lesson 23 provides activities to help reinforce the relationship between numbers and number words and symbols.

Lesson 19: ASSOCIATING NUMBERS AND NUMERAL SYMBOLS

Printed numerals are introduced in this lesson. Playing games with the cards will help the children learn about the numerals.

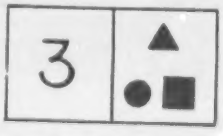
MATERIALS

- sets of numeral cards -- 0 through 10
- a larger set of numeral cards
- 9" x 12" drawing paper
- stickers -- stars, etc. (optional)
- puzzle cards

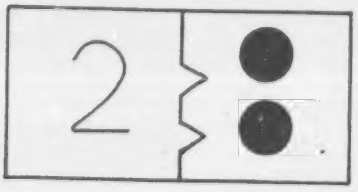
PROCEDURE

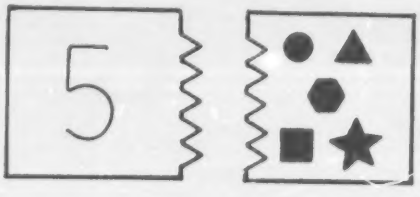
[A] Display the larger numeral cards one at a time. Have the children select matching cards from their sets, recite the number word corresponding to each symbol and hold up the correct number of fingers.

[B] Use 9" x 12" drawing paper to make a set of cards showing the numerals 0-10. Print a numeral on one half of the card as shown below and then have individual children draw a corresponding set of object pictures or paste the appropriate number of stickers on the other half of a card.



[C] Puzzle Cards: Make several cards such as those in the following example. Have the children mix them up and fit them together again.





(Note: This is also a commercial game called "Numberite" procurable from the Judy Company.)

Lesson 20: NUMBERS, NUMERALS AND SYMBOL ORDER

This lesson continues the association of printed numerals with numbers, with special emphasis on the number sequence.

MATERIALS

- counters (at least 55 of each of two colors)
- 22 plastic containers or paper cups
- sets of numeral cards

PROCEDURE

[A] Distribute one set of numeral cards to each child. Call out the number words and have each child select the proper symbol for the number. As they become proficient, call out several numbers in succession and have the cards arranged in order. Have the class practice putting the cards in the proper sequence on the chalk tray. Individual children are not expected to perform this with complete accuracy at this time.

[B] Make up two sets of containers, labeled from 1 to 10. Place the appropriate number of counters -- all of one color -- in each container of one set.

Give a child the second set of empty containers and the counters of the other color. Ask the child how many counters he thinks he should put in the container marked "1" -- designating it only by pointing. If he does not know, have the class help him. Then let him place in each container the number of counters indicated by the numeral on it. He should then check his set with your set, comparing counters on a one-to-one basis to see if his work is accurate. The number words associated with the numbers should be used frequently.

Once this activitiy is understood and done reasonably well, include an unmarked container.

HOW SHOULD WE MARK IT IF WE WANT NO COUNTERS IN ITS SET?

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Talk about the "empty" set and use the number "zero" with the symbol "0." Write the symbol on the container and include it in the set.

C "Scramble": Eleven children, each holding one of the numerals from 0-10, are "scrambled" so that the numerals are out of sequence. The other children try to unscramble the card holders, lining them up correctly from 0-10.

Now place the mixed-up cards on the chalk tray. Individual children, or children in groups, may be chosen to put the numerals in order.

Lesson 21: INCREASING NUMBERS BY ONE OR TWO

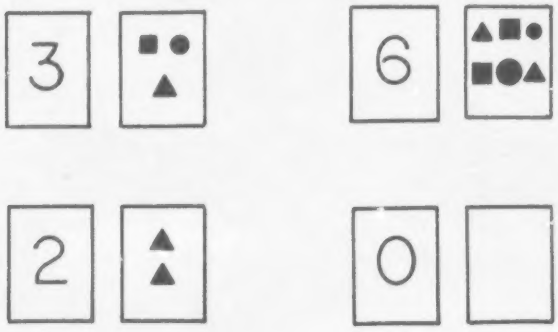
These activities provide more practice in counting. They also give the children some practice in pre-addition and in predicting and checking totals up to ten or so. The continued use of physical objects with their counting exercises intuitively reinforces the children in the concept that numerals are symbols for numbers of objects. Varying the kinds of objects used also reinforces the concept of number and its relation to numerals.

MATERIALS

- large display cards (9" x 12") with numerals on one side and pictures on the other.
- sets of cards with numerals 0 - 10

PROCEDURE

[A] Prepare a set of eleven large display cards (9" x 12") with numerals from 0 - 10 on one side and a set of pictures of appropriate number on the opposite side. Sometimes have all the pictures alike, sometimes all different and sometimes repeat only a few. This helps the child to think of the abstract "threeness," for example, rather than thinking of "three alike" or "three different."



Place any large display card in the chalkboard tray with the picture side showing. Ask the children how many are in the set shown. Have them select and show the proper numeral card. Next ask a child to pick (without looking at the numeral side) a card that has a picture of a set with "one more" or "one less" member. Have him place the card he has selected to the right or left of the other. Proceed until the complete sequence has been developed. When all the picture cards are in order, turn the cards so that the numerals show. The children can now see the corresponding numeral sequence. Ask the children to recite the number names in order.

[B] Have the children order cards starting from about 5. Ask for "one more," or "one less."

Lesson 22: "BANKING" GAME

This lesson extends the "banking" of activity D, Lesson 17, to the use of number symbols and simple pre-subtraction experiences.

MATERIALS

- counters

PROCEDURE

Select a child to be the banker or "counter," and give him a maximum of five objects. Give ten other children each one object. Each child, in turn, then comes to the banker with his object. The banker says, "I have _____ objects. You give me one." The "customer" gives his object to the banker. Then the banker says, "Now I have _____ objects." Whenever a number is mentioned, have a child select and display the proper numeral card. The children take turns at being the banker and being a customer.

Now, after choosing a banker, give other children a varied number of objects (one or two) to give him. As the banker receives each child's object or objects, both he and the customer report the number of objects the banker has after each transaction. (At first, the children should not have to total beyond ten.)

Next, select a banker and give him three objects. Then distribute one, two or three objects to each of ten other children. Have one of the ten children approach the banker and say, "You have _____ objects. I have _____ objects. I give you _____. Now I think you have _____ objects. Count and see if I am right." The banker counts and says, "Now I have _____ objects." They both count and check. (For more participation, you may appoint more bankers and let customers go to any of them.)

If you think some of your children would enjoy it, you might like to try a pre-subtraction activity. Provide each banker with ten objects and let customers withdraw one, two or three objects, adjusting the conversation to suit -- the banker saying, for example, "I have ten objects. I give you two objects. Now I have eight objects left." Both children would then check for accuracy.

Lesson 23: NUMBER SYMBOL SEQUENCE

A number of suggested activities are provided for reinforcing the relations between numbers and number words and symbols. Use whichever seem most desirable for your class. Undoubtedly you will think of appropriate variations.

MATERIALS

- numeral cards
- counters -- 20 per child
- plastic bags

PROCEDURE

[A] Distribute to each child a set of numeral cards (0-5) and a plastic bag containing about 20 small counters. Ask each child to place on the table or floor as many counters as he has fingers on one hand, if necessary pairing the counters with his fingers. (Should the question arise, say that for this game the thumb is considered a finger.) Have the children place their counters in a row. Then have them put the correct numeral card beside each counter, to show how many counters are in the set. Check to see if everyone is correct, taking time to help those who are having difficulty. Or let neighboring children check and help each other. Continue this activity by asking each child to put down as many counters as he has toes on one foot, eyes, nose, etc., each time putting the correct numeral card beside each counter.

[B] Vary the activities in A by making up situations such as "Mary went to the store to get four oranges. With your counters and cards, show me how many she got." Later, when the children understand the relationship between the objects and the numeral that represents their number, they can omit the counters and just use the numeral cards for showing answers.

[C] "What's Missing?" Stand the numeral cards 0 - 5 (0 - 10 with the more capable children) in order in the chalk tray. Then select a child to remove one card from the sequence, while the children close their eyes. (Leave the gap

at first, closing it later and making the activity harder.) Then have the children open their eyes and determine which numeral is missing. Replace the missing card and let the first child choose another child to remove a card.

[D] Show the children a set of common objects from the room -- 6 pencils or 4 crayons and 2 rulers, for instance. Using the numeral cards, have a child count the objects by placing the cards sequentially one by one on the objects as they count. They will be matching an object with a numeral by one-to-one correspondence -- just as they matched an object with another object in previous lessons. But here they are required to match the numerals in a specific sequence. It should become evident to them that the last numeral always indicates the total number in the set.

[E] "Last Child": Two children are chosen to compete to see who can take the last child away from "the circus" (swimming pool, birthday party, or movie). The purpose is to develop a winning strategy when concepts of one and two are used.

Have all the children except Bill and Mary (children chosen to compete) sit or stand in one area. Tell them that they are at the circus, and are having a very good time! Bill and Mary will see which one can take the last child (class member) home from the circus. They may choose one child at a time each turn, or they may choose two -- one child with each hand. The children playing this game alternate turns. Children may play this game in pairs using objects such as blocks, toys, marbles, beads, etc., instead of other children.

Note: Watch for initial discovery of the winning position, and bring out the idea of winning numbers. When there are four children left, the person whose turn it is (player A) could take just one child. Then regardless of whether the other player takes one or two it will not matter because player A will win. If the children do not discover this strategy, they should <u>not</u> be told. Encourage them to continue the game at activity time, at home, etc., until they discover it for themselves.

SECTION 5 OPTIONAL EXTENSIONS

PURPOSE

- To give the children experience with the number relations of coins.
- To give them practice in printing numerals.

COMMENTARY

As indicated in the title of this section, its activities are intended only as suggestions for the teacher who finds them appropriate for her class. After looking them over, you may feel that they should be modified or completely omitted. It is expected that only a few children in any class will master these activities easily.

Lesson 24: COINS AND THEIR VALUES

Because of the disappearance of many of the small neighborhood stores where kindergarten children often went to make small purchases, youngsters are having less and less experience with money. Family charge accounts at local stores are further reducing the number of cash transactions in which children can participate, so it is important that the school provide opportunities for them to learn about money.

MATERIALS

- real coins of each denomination (pennies, nickels and dimes -- include quarters if you wish)
- play money
- pictures of coins
- set of Minnebars
- story, "The Lemonade Stand," pp. 92-99

PROCEDURE

[A] "Name the Coins": In carrying out the following activities, you may find it advantageous to use 1, 5, and 10-unit Minnebars to illustrate the relations of the pennies, nickels and dimes.

Hold up a penny, a nickel and a dime, one at a time.

Have the children name each one.

HOW CAN YOU TELL A PENNY FROM THE OTHER COINS?

WHICH IS LARGER IN SIZE -- A NICKEL OR A DIME?

WHICH IS THE LARGEST COIN OF THESE IN SIZE?

WHICH IS THE SMALLEST COIN IN SIZE?

Give each child a penny, nickel or dime (or play coin, or pictures of coins).

WILL THE SET OF CHILDREN WHO HAVE PENNIES STAND BY THE DESK, PLEASE?

WILL THE SET OF CHILDREN WHO HAVE NICKELS PLEASE STAND BY THE TABLE?

WILL THE SET OF CHILDREN WHO HAVE DIMES STAND OVER HERE, PLEASE?

HOW MANY SETS OF COINS DO WE HAVE?

Have a box with play money in it. During free time the children can sort the coins by name.

[B] "Coin Value": Discuss the value of each coin with the children.

ONE PENNY IS THE SAME AS ONE CENT.

ONE NICKEL WILL BUY AS MUCH AS FIVE PENNIES. WE SAY THAT A NICKEL IS WORTH FIVE PENNIES, FIVE CENTS.

A DIME IS WORTH TEN PENNIES.

IF AN APPLE COSTS FIVE CENTS AND I HAVE FIVE PENNIES, CAN I BUY THE APPLE?

IF I HAVE A NICKEL, CAN I BUY THE APPLE?

Give each child a coin (play coin or picture of coin). Choose a child who has a nickel to stand near you.

HOW MANY CHILDREN WITH PENNIES WILL NEED TO STAND BY PETER TO MATCH THE VALUE OF THE NICKEL?

Have five children with pennies stand by Peter, who has a nickel. Repeat these activities for a dime (and a quarter, if you wish).

IF A NICKEL IS WORTH FIVE CENTS AND A DIME IS WORTH TEN CENTS, HOW MANY NICKELS IS A DIME WORTH?

Divide ten children, each with a penny, into two subsets of five. Have a child with a nickel stand by each subset to show that two nickels are equal to a dime in value.

If you think that your children are ready, repeat the activity, asking how many nickels it would take to have the same value as a quarter.

WHICH WILL BUY MORE, A NICKEL OR A DIME?
WHY?

WHICH WILL BUY MORE, A DIME OR A QUARTER?
WHY?

C Use the accompanying story, "The Lemonade Stand," (pp. 92-99) to reinforce and review the children's understanding of pennies, nickels and dimes.

These printed coins are similar to the play coins supplied with this unit.

THE LEMONADE STAND

Johnny pounded away with his hammer. "Bang, bang, bang," it went. Then he stopped and stepped back. "There, it's all finished!" He looked with pride at his lemonade stand. He had made it by nailing a board across two orange crates. "Now I can sell lemonade to all the people who walk by," he thought.

He ran back to his house. He was so excited he was practically shouting when he called out, "Mom! Mom! My stand is ready. Where's the pitcher of lemonade I mixed up?"

"In the refrigerator," his mother said, "and here are some clean glasses and a box for your money, too. I put some coins in the box, in case you have to make change. You can pay me back tonight."

"Thank you, thank you, Mom!" Johnny shouted over his shoulder, as he went out the door with his big carton of supplies.

"Are you sure you know how to count your money?" Johnny's mother called after him.

"Oh, sure, Mom," Johnny hurried down the walk to his stand.

He scarcely had time to arrange everything the way he wanted it, when a woman customer came along.

"I'd like a glass of lemonade to drink while I wait for the bus," the woman said. "How much is it?"

"It's a nickel a glass." Johnny poured a glassful for her.

The woman paid Johnny with five brownish coins. Johnny looked at them. "These are pennies," he said, "don't you have a nickel?"

The woman looked in her purse. "No, I don't," she said, "but I don't see why you would rather have a nickel. I gave you five pennies. That's five cents. And five cents is the same as one nickel."

"Are you sure these five pennies are worth the same as a nickel?" Johnny asked.

"Of course," the woman said. Then she walked over to the bus stop.

"Five pennies are worth the same as one nickel." Johnny was talking to himself. "That's a very handy thing to know." And he counted the pennies as he dropped them in the box.

LEMONADE

Then a neighbor, Mrs. Brown, came to Johnny's stand. "I'll buy a glass of lemonade, Johnny," she said.

Johnny poured another glassful. "One nickel, Mrs. Brown."

Mrs. Brown gave Johnny a small silvery coin.

"This isn't a nickel," Johnny said. "It's smaller than a nickel."

"Yes, it's smaller in size than a nickel, but it's a dime, and a dime is worth more than a nickel, Johnny. It's worth ten cents. But a nickel is worth only five cents."

"You mean pennies?"

"That's right. One penny is one cent. Five pennies are worth the same as a nickel and ten pennies are worth the same as a dime."

Here let the children tell what they know about the relative value of these two coins. Emphasize the fact that it takes two nickels to be of the same value as a dime, even though a dime is smaller in size.

Johnny thought a while and then said, "A dime is worth two nickels, but the lemonade costs only one nickel. That means I owe you one nickel. Right?"

"Right."

Johnny opened his box of money. He saw the five pennies the first woman had paid him and five nickels his mother had put in for making change.

Discuss the two ways that Johnny could make change.

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"I think I'll give you the five pennies -- they're the same as one nickel." Johnny gave Mrs. Brown the pennies and put the dime in the box. Then he turned and saw his mother coming down the sidewalk toward his stand.

"How are you doing?" she asked. "I thought maybe you'd need help making change."

"Aw, Mom, sometimes you forget that I'm growing up," Johnny said. Then he smiled. "Why don't you have a glass of lemonade while I tell you all about making change?"

"Fine," his mother said, and she stood sipping the good, cool drink while Johnny explained what he had learned about pennies, nickels and dimes.

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Lesson 25: PRINTING NUMERALS (OPTIONAL)

The activities of this lesson are designed to introduce children to the writing of numerals. It is left entirely to your discretion to decide whether or not the children in your class are ready for these writing exercises.

MATERIALS

- a large piece of cardboard or sandpaper
- Worksheets 1 to 5
- newsprint
- crayons

PROCEDURE

[A] To give the children preliminary muscular training in how it "feels" to write numerals, we describe a few of the many methods from which you might choose.

(1) Make large cardboard or sandpaper cutouts of each numeral and encourage the children to trace the cutout shapes with the pointing finger of whichever hand they prefer.

(2) Use crayon to draw the numerals 1 through 10 on 10 pieces of fine sandpaper. Have the children trace these with pointing finger. (They will discover that the outline of the numeral is pleasantly slippery compared to the parts of the sandpaper without crayon.)

[B] Use Worksheets 1 through 5 one at a time. Adapt the following procedure for each of the numerals.

For Worksheet 1, demonstrate the correct printing of numeral 1 on the board. Then have the children trace the solid numeral 1 on the worksheet, first with fingers, then with crayon. Have them repeat this activity with finger and crayon for the dotted numeral 1 and then write the numeral in the blank spaces. (Explain each time that the little x shows where to begin printing the numeral.)

For each worksheet the children are to draw the appropriate number of objects in the space to the left of the first of each numeral. This is illustrated on Worksheet 1.

After providing the children with newsprint and crayons, have them follow up the worksheets by writing each numeral free style and drawing a set with the appropriate number of members to go with each numeral.

In those kindergarten rooms where there are large chalkboards, children might enjoy trying to print with chalk, though the management of chalk is more difficult than crayons for most children.

[C] Provide printing opportunities for the children to write numerals relating to their own experiences. For example: have the children "print the numeral that tells how many wheels are on a tricycle; how many eyes we have; how many toes we have; how many buttons are on John's jacket," etc. Let the children use newsprint and crayons, or the board -- whichever is easier for them.

[D] "Missing Numerals": Write a series of three numerals on the chalkboard. Leave a blank for a missing numeral. If the child fills in the blank correctly, he may write the next set of numerals and the blank.

The first series of numerals may have two numerals and then the blank.

1 2 _____

The second set may have two numerals and the blank in the middle.

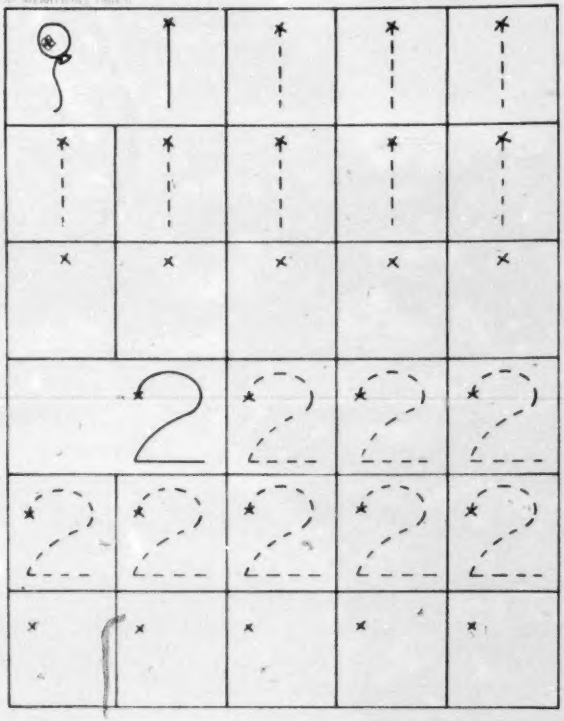
3 _____ 5

The third set may have the blank coming first and then two numerals.

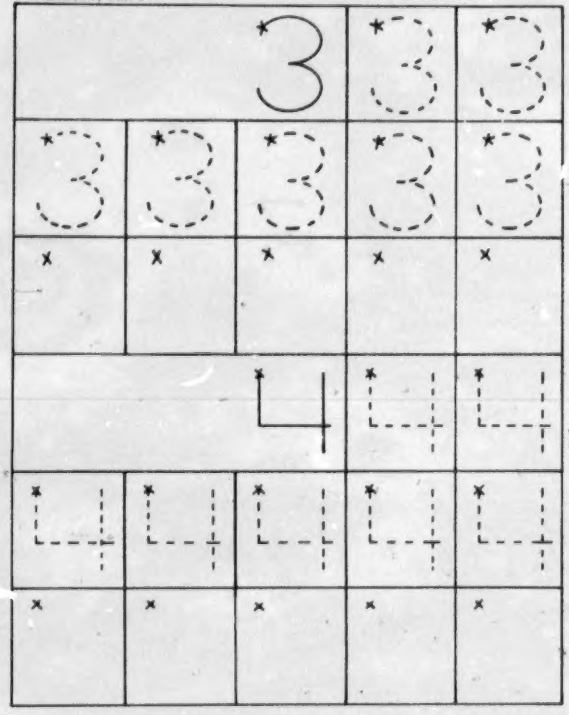
_____ 4 5

E "Art Activity with Numerals": Have the children make a number book. They write the number 1 in the corner of a sheet of paper and draw one object on the paper, write the number 2 on the next page and draw two objects, and continue until they reach number 10. As you check each page, have them count the number of objects they have drawn.

Worksheet 1



Worksheet 2



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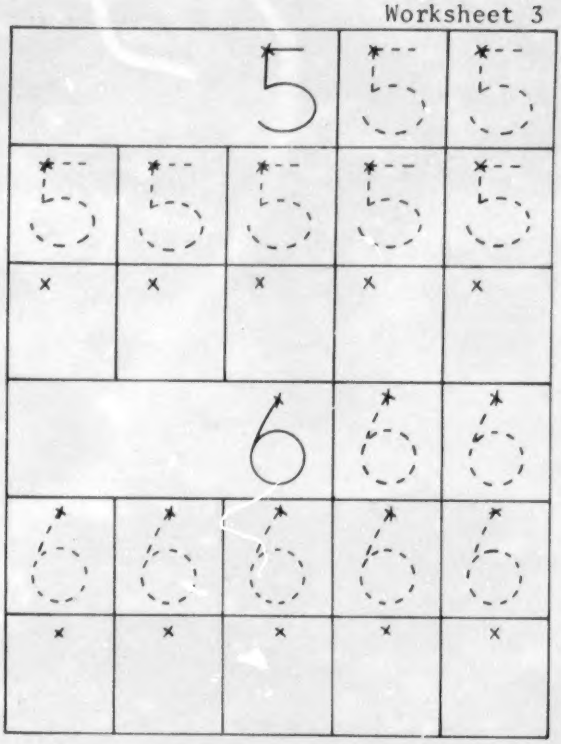
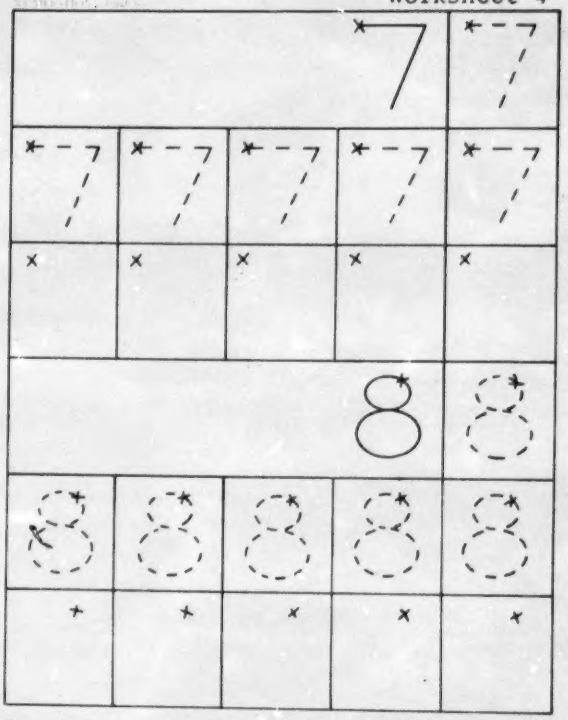
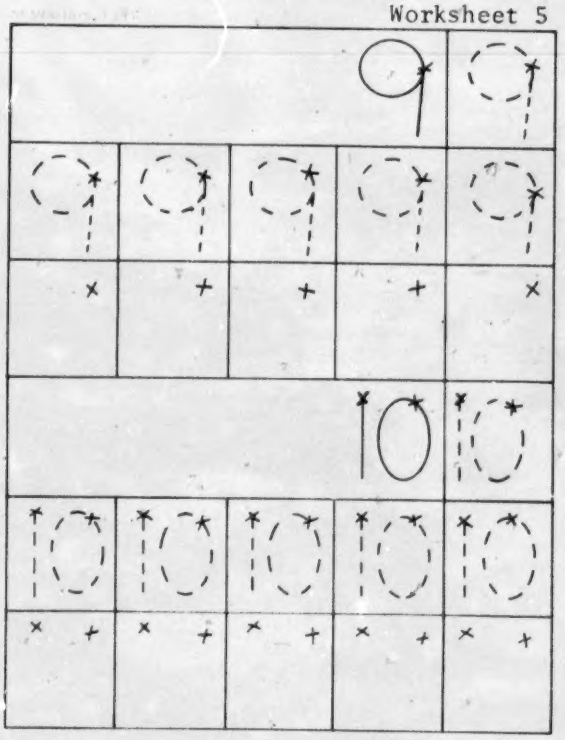
Worksheet 3



Worksheet 4



Worksheet 5